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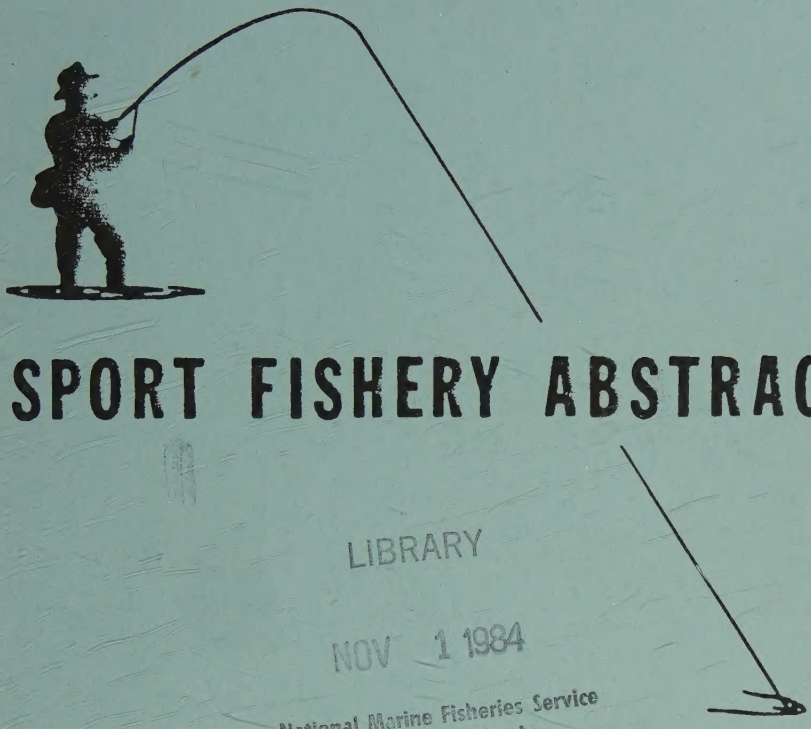

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SPORT FISHERY ABSTRACTS

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Sport Fishery Abstracts is intended to furnish fishery biologists with abstracts of current literature in sport fishery research and management.

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SPORT FISHERY ABSTRACTS

An abstracting service for fishery research and management

Volume 29(3) 1984

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GENERAL FISH CULTURE

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[Kuwait Inst. Sci. Res., P.O. Box 1638, Salmiya, Kuwait] Water quality variables were monitored during 3.5 years of research on pig-fish, duck-fish and chicken-fish systems. Early morning dissolved oxygen levels were often below 0.5mg/l. Total ammonia levels were highest in chicken-fish systems with maximum levels exceeding 6 mg/l. Water quality sampling designs which measure the fluctuations in water quality variables are discussed. Species selection, control of manure loads, addition of new water, and aeration are presented as means to manage water quality in livestock-fish systems.

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[Dep. Agric. Resour. Econ., Univ. Hawaii, 2545 The Mall, Bilger Hall 304, Honolulu 96822]

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[Hokkaido Salmon Hatchery, Nakanoshima, Toyohiraku, Sapporo, Hokkaido, Japan]

TROUT AND SALMON CULTURE

84-001693 Dwyer, W. P. and R. G. Piper. THREE-YEAR HATCHERY AND FIELD EVALUATION OF FOUR STRAINS OF RAINBOW TROUT. *N. Am. J. Fish. Manage.* 4(2):216-221. 1984. SFA 29(3)
[U.S. FWS, Fish Cult. Dev. Cent., 4050 Bridger Canyon Rd., Bozeman, MT 59715] The performance of four strains of rainbow trout, (*Salmo gairdneri*) was evaluated under hatchery and field conditions. Growth, conversion, and survival were measured in the hatchery; catchability, growth and longevity data were collected in the field. Fish from each strain were stocked at equal densities into two ponds near Three Forks, Montana, for a replicated field evaluation. The domestic Winthrop and Spring Standard Growth strains grew faster, converted food more efficiently, and were harvested at a faster rate than the wild McConaughy and Fish Lake strains. However, the McConaughy and to some extent the Fish Lake strains remained in the fishery longer--up to 3 years, at which time the project was terminated.

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[Dep. Ecol. Zool., Univ. Umeå, S-90187 Umeå, Sweden]

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TROUT AND SALMON CULTURE (CONTINUED)

84-001696 CONTINUED SFA 29(3)
[Pestic. Res. Cent., Mich. State Univ., East Lansing 48824] The salmon sport fishery is a major industry in Michigan which is supported by a salmon rearing program. In recent years there has been an increase in rearing mortality over that seen in similar programs at Pacific Ocean hatcheries. This mortality was temperature affected. Previous studies have suggested that trace contaminants are involved but never made a thorough analysis of the contaminants present. Chinook salmon eggs collected from Lake Michigan were reared at 10°, 12°, and 15°C. Egg subsamples were taken and a multiresidue analysis was performed. The identification and quantification of the residues were done on a capillary gas chromatograph. PCB congeners were identified by their relative retention times. Temperature had a significant effect on the hatching mortality. Contaminant analysis revealed that the predominant residues were PCBs, DDTs, toxaphene and chlordanes. Individual analysis of the PCB congeners showed that the predominant congeners were the tetra to the hexachlorobiphenyls. Differences in contaminant levels between eggs did exist suggesting a possible correlation between contaminant egg burdens and fry mortality.

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[Pyramid Lake Tribal Enterprise, Sutcliffe, NV 89510]

84-001699 Sorensen, R. CULTURING ARIZONA NATIVE TROUT (*SALMO APACHE*). *Proc. Annu. Conf. West. Assoc. Fish Wildl. Agencies* 62:433. 1982. Abstract only. SFA 29(3)
[Ariz. Game Fish Dep., Page Springs Hatchery, Cornville, 86325]

84-001700 Wilcox, K. W.: J. Stoss and E. M. Donaldson. BROKEN EGGS AS A CAUSE OF INFERTILITY OF COHO SALMON GAMETES. *Aquaculture* 40(1):77-87. 1 July 1984. SFA 29(3)
[Univ. British Columbia, Dep. Poultry Sci., Vancouver, BC V65 2A2, Canada]

OTHER ANADROMOUS SPECIES CULTURE

84-001701 Campbell, D. L. PRELIMINARY HYBRID STRIPED BASS (*MORONE CHRYSOPS* x *MORONE SAXATILIS*) FEEDING STUDY. *Annu. Proc. Tex. Chap. Am. Fish. Soc.* 2:66-72. 1980. SFA 29(3)
[Tex. Parks Wildl. Dep., Tyler 75709] A preliminary study to determine the best feeding method of 5 to 40 day old hybrid bass (white bass x striped bass) was made at the Tyler Fish Culture Station during 1979. Eight different diets were used. The combination of *Artemia sp.*, *Chlorella sp.*, and *Chlamydomonas* sp. followed by Master Mix F-45 Starter produced the best results

WARMWATER CULTURE

84-001702 Anders, E. DER EINSATZ VON Gn-RH VET., "BERLIN-CHEMIE" ZUR STIMULATION DER LAICHREIFE BEIM KARPFEN (*CYPRINUS CARPIO*). [USE OF Gn-RH VET. "BERLIN CHEMIE" TO STIMULATE SPAWNING MATURITY OF CARP (*CYPRINUS CARPIO*).] *Monatsh. Veterinarmed.* 39(8):276-277. 1984. In German with English and Russian summ. SFA 29(3)
[Inst. Hochseefisch. Fischverarbeit. Rostock, Versuchsanlage Born, West Germany]

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[Dep. Entomol. Fish., Coastal Plain Exp. Stn., Univ. Ga., Tifton 31793]

84-001706 Bondari, K. PERFORMANCE OF DOMESTIC AND DOMESTIC X WILD CROSSES OF CHANNEL CATFISH IN TWO WATER TEMPERATURES. *J. World Maricult. Soc.* 14:661-667. 1983. SFA 29(3)
[Dep. Entomol. Fish., Coastal Plain Exp. Stn., Univ. Ga., Tifton 31793] Domestic x Domestic, Domestic x Wild, and Wild x Wild channel catfish (*Ictalurus punctatus*) were paired in individual spawning pens and subsequent egg masses were artificially incubated. Domesticated catfish originated from 5 different hatcheries located in Georgia, Alabama, and Mississippi and since 1974 had undergone selective breeding for 2 generations for multiple traits. Wild catfish were collected from Carlyle and Shelbyville reservoirs in Illinois and were transferred to Tifton, Georgia, for this study. None of the 8 Wild x Wild pairs spawned in captivity, but the 8 Wild ♀ x Domestic ♂ and the 8 Domestic ♀ x Wild ♂ produced 3 and 6 egg masses, respectively. The fry hatched from each of the 14 egg masses (5 from Domestic x Domestic) were standardized to 2 tanks of 500 fish each at 4 weeks of age where one tank received 22°C well water and the other 28°C from 4-12 weeks. The fish from both tanks were grown in a constant 22°C water temperature from 12-40 weeks. The objective was to produce crossbreds superior to both parents in growth and survival in 22°C well water. An increment of 6°C in water temperature for a period of 8 weeks increased body weights of both straightbred and cross bred catfish by 100%. Domestic x Domestic catfish outperformed the Domestic x Wild crossbreds in both temperature regimes. These results suggest a stronger need for growth improvement through selective breeding of channel catfish than crossbreeding with wild strains.

84-001707 Boyd, C. E. and J. L. Shelton, Jr. OBSERVATIONS ON THE HYDROLOGY AND MORPHOMETRY OF PONDS ON THE AUBURN UNIVERSITY FISHERIES RESEARCH UNIT. *Ala. Agric. Exp. Stn. Bull.* 558. 63p. Feb. 1984. SFA 29(3)
[Dep. Fish. Allied Aquacult., Auburn Univ., Auburn, AL]

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84-001710 Carr, B. A. POPULATION DENSITY EFFECTS ON THE BEHAVIOR AND FEEDING OF YOUNG STIPED MULLET (*MUGIL CEPHALUS*) IN 37.8-LITER AQUARIA. *Proc. Annu. Meet. World Maricult. Soc.* 13:254-260. 1982. SFA 29(3)
[Fish. Sect., Room 249 Ag. Cent., La. State Univ., Baton Rouge 70803] The swimming and feeding behavior of striped mullet (*Mugil cephalus*), 40-60 mm SL, was observed in 37.8-liter aquaria. Five of the most frequently observed behavioral acts were then chosen as representatives of "normally" occurring behavior under these experimental conditions. These behavioral acts were subsequently counted in the 37.8-liter aquaria with population densities of 3, 6, 18, 30 and 60 mullet per aquaria, during swimming and feeding observations. More food bites were taken at densities of 18 and 30 than at the other densities. Mullet kept at a density of 30 per tank exhibited the lowest mean number of long traverses (a distance of more than one-half the aquarium front). Perhaps at a density of 30 mullet per aquarium (0.79 mullet/liter or 231 mullet/m^2), food was assimilated into biomass and less was burned for energy. Obtaining data in aquaria in this manner may prove an invaluable tool since it is less expensive than stocking ponds experimentally and can provide a useful basis for deciding efficient stocking densities for any size fish.

84-001711 Crawford, T. and M. Freeze. POLYCULTURE OF GIANT MALAYSIAN PRAWNS (*MACROBRACHIUM ROSENBERGII*) AND FATHEAD MINNOWS (*PIMEPHALES PROMELAS*). *Proc. Ark. Acad. Sci.* 36:85-86. 1982. SFA 29(3)
[Ark. Game Fish Comm., P.O. Box 178, Lonoke 72086]

84-001712 Dimitrov, M. INTENSIVE POLYCULTURE OF COMMON CARP, (*CYPRINUS CARPIO* L.) AND HERBIVOROUS FISH [SILVER CARP, *HYPOPHTHALMICHTHYS MOLITRIX* (VAL.), AND GRASS CARP, *CTENOPHARYNGODON IDELLA* (VAL.)] *Aquaculture* 38(3):241-253. 15 May 1984. SFA 29(3)
[Freshwater Fish. Res. Inst., Polvdiv 4003, Bulgaria]

84-001713 Harvey, B. and R. N. Kelley. SHORT-TERM STORAGE OF *SAROTHERODON MOSSAMBICUS* OVA. *Aquaculture* 37(4):391-395. 1 Apr. 1984. SFA 29(3)
[Dep. Biol., Univ. Victoria, P.O. Box 1700, Victoria, BC V8W 2Y2, Canada]

84-001714 Heckmann, R. A.; R. N. Winget; R. C. Infanger; R. W. Mickelsen and J. M. Hendersen. WARM WATER AQUACULTURE USING WASTE HEAT AND WATER FROM ZERO DISCHARGE POWER PLANTS IN THE GREAT BASIN. *Great Basin Nat.* 44(1):75-82. 31 Jan. 1984. SFA 29(3)
[Dep. Zool., Brigham Young Univ., Provo, UT 84602] Two series of experiments were completed to determine (a) toxicity of waste water from

WARMWATER CULTURE (CONTINUED)

84-001714 CONTINUED power plants on warm water fish and (b) multiple use of waste heat and water for aquatic animal and plant production. All three types of waste water from a typical coal-fired power plant are acceptable for growing catfish and tilapia following aeration. This growth was compared with fish raised in spring water. Closed, recirculating polyculture systems using evaporation pond water operated efficiently for plant (duckweed) and animal (fish and freshwater prawns) production. Duckweed is an excellent supplement for fish feed. Tilapia and freshwater prawns grew rapidly in the tanks containing duckweed only.

84-001715 Inslee, T. D. SPAWNING AND HATCHING OF THE RAZORBACK SUCKER *(XYRAUCHEN TEXANUS). Proc. Annu. Conf. West. Assoc. Fish Wildl. Agencies* 62:431-432. 1982. Abstract only. SFA 29(3)
[U.S. FWS, P.O. Box 217, Dexter, NM 88230]

84-001716 Kerby, J. H.; L. C. Woods III and M. T. Huish. POND CULTURE OF STRIPED BASS X WHITE BASS HYBRIDS. *J. World Maricult. Soc.* 14:613-623. 1983. SFA 29(3)
[N.C. Coop. Fish. Res. Unit, P.O. Box 5577, N.C. State Univ., Raleigh 27650] Four 0.1-hectare earthen ponds were stocked with two densities (10,000 and 15,000 fish/hectare) of female striped bass (*Morone saxatilis*) X male white bass (*M. chrysops*) hybrids on 30 October 1980. Mean weight at stocking was 20 g. Fish were fed ad libitum 2 or 3 times daily with a dry commercial salmon diet, and ponds were aerated mechanically during periods of low dissolved oxygen in warm months. Survival to harvest about 13 months later (22 November 1981) averaged 50% in the low density ponds and 93% in one high density pond. Total mortality of fish in the other high density replicate occurred in late August after an aerator failed. Survival until then was 92%. At harvest, mean weight of fish was 465 g in the low density ponds and 351 g in the high density pond. The average food conversion ratio of dry food to wet fish weight was 1.58:1. Standing crop at harvest averaged 2,312 kg/hectare in the low desnity ponds and was 4,886 kg/hectare in the high density pond. Growth was positively correlated with temperature, with the most rapid growth rates occurring during periods of high mean water temperatures. The study demonstrated that the hybrids can be grown to marketable sizes in ponds within 15-18 months of age at densities similar to those used in culture of channel catfish (*Ictalurus punctatus*). In view of their high market value, we believe that this hybrid has considerable potential for culture as a commercial food fish or perhaps for use in fee-fishing ponds.

84-001717 Marsh, P. C. and M. S. Pisano. INFLUENCE OF TEMPERATURE ON DEVELOPMENT AND HATCHING SUCCESS OF NATIVE COLORADO RIVER FISHES. *Proc. Annu. Conf. West. Assoc. Fish Wildl. Agencies* 62:434. 1982. Abstract only. SFA 29(3)
[Cent. Environ. Stud., Ariz. State Univ., Tempe 85287] Razorback sucker, (*Xyrauchen texanus*), bonytail chub (*Gila elegans*), humpback chub (*G. cypha*), and Colorado squawfish (*Ptychocheilus lucius*) eggs were spawned and fertilized at 17C, and ova then incubated at 5, 10, 15, 20, 25, and 30C. Total mortality of all ova occurred in 12-96 hours at 5, 10, and 30C; and in 48-60 hours at 15C for *P. lucius* only. Survival and percentage hatch was highest at 15-20C (*G. elegans*) or 20C (all others). Hatched prolarvae were 0.2-1.3 mm TL longer at 20C than at 15 or 25C. Spinal or other anomalies were more frequent at 15 and 25C than at 20C. Development rates were similar for all species, 4.4-6.1 (15C), 8.4-9.9 (20C), and 12.4-18.8 (25C). Development rate (V): temperature (T) relationships defined as $V = mT + b$, were similar for all species, all were highly significant ($r^2 = 0.77-0.99$), and indicated a "zero development" temperature range of 8.6C (*G. elegans*) to 12.2C (*P. lucius*). Because of lower survival and

WARMWATER CULTURE (CONTINUED)

84-001717 CONTINUED significantly higher incidence of anomalies at 15 and 25C, the optimal temperature for development and hatching of these species is probably near 20C. This suggests that reproduction may be limited by low water temperatures throughout much of the Colorado River, although successful hatching is certainly not precluded. Other hypotheses to explain the real or apparent demise of these fishes in the River, such as predation upon young, should be examined.

84-001718 Newton, S. H.; C. J. Haskins and J. M. Martin. POLYCULTURE OF BUFFALO HYBRIDS WITH CHANNEL CATFISH. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 35:562-565. 1981. SFA 29(3)
[Agric. Dep., Univ. Ark., Pine Bluff 71601] Bigmouth buffalo (BM) (*Ictiobus cyrinellus*) X black buffalo (BL) (*I. niger*) and BL X BM were compared with BM parentals when reared in polyculture with channel catfish (*Ictalurus punctatus*), grass carp (*Ctenopharynogodon idella*), and largemouth bass (*Micropterus salmoides*) over a 2-season period. All buffalo were 1 year old when stocked and 2 1/2 years of age at harvest. All other fish were yearlings when stocked. Stocking rates per hectare were 2500 catfish, 30 grass carp, 100 bass and 250 buffalo. At harvest, catfish averaged slightly over 1 kg each, while bigmouth, BL X BM, and BM X BL hybrids were 2.86, 2.93, and 2.14 kg, respectively. Grass carp averaged 3.33 kg each for all combinations. Highest catfish yields and greatest total fish production were achieved in the polyculture combinations. The polyculture stocking combination with bigmouth buffalo was best with BL X BM next. The monoculture yield was lowest, even when just catfish production was compared.

84-001719 Robison, W. R. and S. H. Newton. EFFECT OF STOCKING DENSITY ON CHANNEL CATFISH GROWTH, SURVIVAL AND FOOD CONVERSION EFFICIENCY IN CAGES. *Proc. Ark. Acad. Sci.* 36:101-102. 1982. SFA 29(3)
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[Dep. Agric., Univ. Ark., Pine Bluff 71601]

84-001721 Romanenko, V. D. METABOLIC ASPECTS OF WARMWATER CULTURE OF THE CARP, *CYPRINUS CARPIO* L. *Aquaculture* 38(4):307-314. 1 June 1984. SFA 29(3)
[Inst. Hydrobiol., Acad. Sci. Ukrainian SSR, Kiev, USSR]

84-001722 Schroeder, G. L. NATURAL FOOD WEB CONTRIBUTIONS TO FISH GROWTH IN MANURED PONDS AS INDICATED BY STABLE CARBON ISOTOPE RATIOS. *J. World Maricult. Soc.* 14:505-509. 1983. SFA 29(3)
[Agric. Res. Organ., Dor, Hof HaCarmel, Israel 30-820]

84-001723 Torrans, E. L. and H. P. Clemens. COMMERCIAL POLYCULTURE OF BIGMOUTH BUFFALO AND CHANNEL CATFISH IN OKLAHOMA. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 35:554-561. 1981. SFA 29(3)
[Agric. Dep., Univ. Ark., Pine Bluff 71601]

84-001724 Tucker, C. S. and S. W. Lloyd. PHYTOPLANKTON COMMUNITIES IN CHANNEL CATFISH PONDS. *Hydrobiologia* 112(2):137-141. 22 May 1984. SFA 29(3)
[Miss. Agric. For. Exp. Stn., Delta Br. Exp. Stn., Storesville 38776]

WARMWATER CULTURE (CONTINUED)

84-001725 Zonneveld, N. THE SPAWNING SEASON AND THE RELATION BETWEEN TEMPERATURE AND STRIPPING TIME OF GRASS CARP (*CTENOPHARYNGODON IDELLA* VAL.) IN EGYPT. *Bamidgeh* 36(1):21-29. Mar. 1984. SFA 29(3)

[Gravenpark 1, 2902 LC Capelle aan den Ijssel, Netherlands] The spawning season of grass carp in Egypt is determined by production level and extends from the begining of April till the end of June under ambient water temperatures. Reproduction can successfully be induced after 950°PT. During the spawning season a pre-optimum and post-optimum period can be distinguised in which the response of females to the hypophysation and the hatching rates vary. The relation between water temperature and stripping time of females appeared to be linear in the 20-30°C temperature range. These results are compared with data from literature.

MARICULTURE

84-001726 Akatsu, S.; K. M. Al-Abdul-Elah and S. K. Teng. EFFECTS OF SALINITY AND WATER TEMPERATURE ON THE SURVIVAL AND GROWTH OF BROWN-SPOTTED GROUPER LARVAE (*EPINEPHELUS TAUVINA*, SERRANIDAE). *J. World Maricult. Soc.* 14:624-635. 1983. SFA 29(3)

[Maricult. Fish. Dep., Kuwait Inst. Sci. Res., P.O. Box 1638, Salmiya, Kuwait] Effects of salinity on the survival and growth of *Epinephelus tauvina* larvae were tested at 39, 25, 25 to 39 (increasing at a rate of 4-5 ppt/week) and 39 to 25 ppt (decreasing at a rate of 4-5 ppt/week). No significant differences in survival and growth were observed among the range of salinities tested during the early larval stages (newly-hatched to 21-day old). However, for the later larval stages (21-40 day old), significantly higher survival and growth were recorded at a constant salinity of 25 ppt. Salinity tolerance limits of newly-hatched larvae were also investigated. Time to LH_{50} (median lethal hour) was recorded to be around 14, 51, 153, 144, 131, 118, 103 and 82 hours after stocking for larvae tested at salinities of 0, 4, 8, 12, 16, 24, 32 and 40 ppt, respectively. Larval survival and growth were tested in 39 ppt salinity at temperatures of 18, 23, 27, 28, 29 and 31°C for newly-hatched to 12-day-old larvae and 28, 29 and 31°C for 19-33 day old larvae. Best survival and growth were recorded at 27-29°C for larvae between newly-hatched to 12-day-old and at 30-31°C for larvae of 19-33 day old.

84-001727 Doroshov, S. I. and P. B. Lutes. PRELIMINARY DATA ON THE INDUCTION OF OVULATION IN WHITE STURGEON (*ACIPENSER TRANSMONTANUS* RICHARDSON). *Aquaculture* 38(3):221-227. 15 May 1984. SFA 29(3)

[Aquacult. Prog., Dep. Anim. Sci., Univ. Calif., Davis 95616] Forty-six white sturgeon females captured prior to their spawning migration in the San Franciso Bay and during their spawning run in the Sacramento River were induced to ovulate with three different hormonal substances: white sturgeon and common carp crude pituitary extracts, and [D-Ala^6] GnRH analogue. All three inducing agents were potent at the respective doses of 2.5 mg, 4.0 mg and 0.1 mg dry matter per kilogram of female body weight. The best ovulatory responses and egg fertilities were observed in fish administered hormonal treatment during the months of March and April. Fish captured prior to and during their spawning migration exhibited similar spawning success.

84-001728 Eisawy, A. and E. Wassef. PRELIMINARY STUDIES ON REARING OF THE GILTHEAD SEABREAM, *SPARUS AURATA* (L.), IN BRACKISH WATER PONDS. *Aquaculture* 38(3):255-260. 15 May 1984. SFA 29(3)

[Inst. Oceanogr. Fish., Alexandria, Egypt]

MARICULTURE (CONTINUED)

84-001729 Girin, M. CULTIVATION OF MARINE FISH IN THE WORLD. *Proc. Annu. Meet. World Maricult. Soc.* 13:9-17. 1982. SFA 29(3)
[France Agriculture, Brest, France]

84-001730 Jones, F. V. and K. Strawn. GROWTH AND FOOD UTILIZATION OF CAGED ATLANTIC CROAKER AND STRIPED MULLET REARED ON VARIOUS LIPID DIETS IN A HEATED WATER SYSTEM. *J. World Maricult. Soc.* 14:590-594. 1983. SFA 29(3)
[City Houston Publ. Works, 12555 Clinton Dr., Houston, TX 77229] Atlantic croaker and striped mullet were caged-cultured in the cooling lake of a power plant near Baytown, Texas, from 30 May to 2 September 1978 to determine the effects of semi-purified diets on growth. These diets varied in the type of lipid utilized (fish oil, beef tallow or soybean oil). Temperature, salinity, pH and dissolved oxygen were monitored to determine growth rates. Survival was generally high, ranging from 80 to 100%, except for one cage of croaker which broke from its mooring line resulting in an 80% loss. Total production ranged from 3.1 to 5.4 kg/m^3 and 0.55 to 2.5 kg/m^3 for Atlantic croaker and striped mullet, respectively. Percent gains and production were highest for fish fed diets containing fish oil as a lipid source, rather than beef tallow or soybean oil.

84-001731 Jones, F. V. and K. Strawn. ASPECTS ON THE GROWTH AND FEEDING BEHAVIOR OF CAGE-POLYCULTURED MARINE FISH IN A HEATED WATER SYSTEM. *Proc. Annu. Meet. World Maricult. Soc.* 13:187-197. 1982. SFA 29(3)
[Houston City Publ. Works, San Jacinto Water System, 12555 Clinton Dr., P.O. Box 24067, Houston, TX 77229] Striped mullet (*Mugil cephalus*), black drum (*Pogonias cromis*), and Atlantic croaker (*Micropogonias undulatus*) were cage-polycultured in a cooling lake of a power plant near Baytown, Texas, from 1 September 1976 through 24 August 1977 to determine production rates and species interaction. Temperature, salinity, pH and dissolved oxygen were monitored daily. Fish were measured and weighed monthly to determine growth rates. Feeding behavior was checked bimonthly for each cage of fish. Survival in most cages ranged from 60 to 100% for all species until May 1977 when the majority of monocultured black drum died in one cage due to fouling and subsequent low dissolved oxygen. Total production ranged from 7.86 kg/m^3 for monocultured striped mullet to 45.09 kg/m^3 for black drum and Atlantic croaker in polyculture. Percent gains in weight were higher in polyculture for black drum and striped mullet over monoculture; however, growth rates were similar for Atlantic croaker between treatments. Black drum and Atlantic croaker had similar feeding behavior, but their aggressive feeding differed as to time of day. Striped mullet were non-aggressive feeders and rarely consumed prepared feeds. Black drum-striped mullet combinations provided the maximum yields with the least amount of aggression between species.

84-001732 Larsson, P. O. REMOTE STRAYING OF SALMON (*SALMO SALAR* L.) FROM THE SWEDISH WEST COAST AND POSSIBLE EFFECTS ON SEA RANCHING OPERATIONS. *Aquaculture* 38(1):83-87. 15 Apr. 1984. SFA 29(3)
[Sea Biol. Div., Salmon Res. Inst., S-810 70, Älvkarleby, Sweden] Some 6500 recaptures of salmon tagged as smolts on the Swedish west coast in 1966-1980 were reviewed for remote strayers. Only 27 (0.43%) were found, meaning no risk for the profitability of sea ranching activities. Along the Swedish west coast at least 450 kg salmon per 1000 released smolts can be expected to be caught by Swedish commercial fishermen, which makes public sea ranching highly profitable there.

MARICULTURE (CONTINUED)

84-001733 McEvoy, L. A. OVULATORY RHYTHMS AND OVER-RIPENING OF EGGS IN CULTIVATED TURBOT, *SCOPHTHALMUS MAXIMUS* L. *J. Fish Biol.* 24(4):437-448. Apr. 1984. SFA 29(3)
[Dep. Zool., Univ. Coll. Swansea, Singleton Park, Swansea SA2 8PP, Wales]

84-001734 Roberts, D. E., Jr. and R. A. Schlieder. INDUCED SEX INVERSION, MATURATION, SPAWNING AND EMBRYOGENY OF THE PROTOGYNOUS GROUPER, *MYCTEROPERCA MICROLEPIS*. *J. World Maricult. Soc.* 14:639-649. 1983. SFA 29(3)
[Fla. Dep. Nat. Reosur., Mar. Res. Lab., St. Petersburg, FL 33701-5095] Female gag (*Mycteroperca microlepis*) were collected from the Eastern Gulf of Mexico, maintained in closed systems and spawned. Sex inversion of this protogynous grouper was induced with oral application of methyltestosterone. Ovotestes of transitional males were described. Photoperiod, temperature, and hormone application were utilized to induce maturation and ovulation of females. Approximately 26,000 eggs were produced in 2 spawns. Fertilization rate was 50%. Larvae hatched after 45 hours at 21.0°C. Embryonic and early larval stages were described.

84-001735 Tseng, W. PROSPECTS FOR COMMERCIAL NETCAGE CULTURE ON RED GROUPER (*EPINEPHELUS AKAARA* T. & S.) IN HONG KONG. *J. World Maricult. Soc.* 14:650-660. 1983. SFA 29(3)
[Dep. Fish., Papua New Guinea Univ. Technol., Lae, Papua New Guinea]

84-001736 Van Olst, J. C.; J. M. Carlberg; M. H. Massingill; T. A. Hovanec; A. Fusfeld and S. Nakhoul. PRELIMINARY INVESTIGATIONS ON THE CULTURE OF STRIPED BASS IN SEAWATER. *Proc. Annu. Meet. World Maricult. Soc.* 13:282-283. 1982. SFA 29(3)
[Aguatic Systems Inc., 11211 Sorrento Valley Rd., San Diego, CA 92121]

84-001737 Woods, L. C. III; J. H. Kerby and M. T. Huish. ESTUARINE CAGE CULTURE OF HYBRID STRIPED BASS. *J. World Maricult. Soc.* 14:595-612. 1983. SFA 29(3)
[Crane Aquacult. Facility, P.O. Box 1475, Baltimore, MD 21203] Nine 0.5-m^3 cages were stocked with three densities (100, 150 and 200/m^3) of female striped bass x male white bass hybrids that averaged 44.6 g on 10 April 1981. Fish received a dry, floating commercial trout diet ad libitum 2 or 3 times daily. Survival to harvest (22 November 1981) for all densities averaged 95% with a mean weight per fish of 333 g. Growth of the hybirds was positively correlated with temperature, and greatest growth occurred during the period of highest water temperatures. Growth was negatively correlated with salinity. The mean coefficient of condition (K) was approximately 1.5 for the hybrids. No significant differences ($P \leq 0.05$) were found in terms of growth in length, weight or condition of the hybrids, between densities. Biomass at harvest averaged 46.6 kg/m^3 with a maximum of 62.2 kg/m^3 for a high density replicate. A combined feed conversion ratio of dry feed to wet fish weight was 1.58:1. Results demonstrated the potential of the hybrid striped bass for use in aquaculture and indicate that the hybrids can be grown to commercial size within 18 months in small cages at densities as high as 200 fish/m^3. Additional information was obtained for striped bass held in cages at a density of 50 fish/m^3.

FEEDS, FEEDING, AND NUTRITION

84-001738 Anderson, J.; A. J. Jackson; A. J. Matty and B. S. Capper. EFFECTS OF DIETARY CARBOHYDRATE AND FIBRE ON THE TILAPIA *OREOCHROMIS NILOTICUS* (LINN.). *Aquaculture* 37(4):303-314. 1 Apr. 1984. SFA 29(3)
[Dep. Biol. Sci., Univ. Aston, Birmingham B4 7ET, England] Glucose, sucrose, dextrin, starch and *a*-cellulose were incorporated into experimental rations at three levels (10%, 25% and 40%) and fed to juvenile *O. niloticus* for 63 days. Inclusion level was adjusted with polypropylene powder. Growth improved as the level of glucose, sucrose, dextrin and starch was increased from 0% to 40%. Carcass fat similarily increased with the addition of assimilable carbohydrate (maximum level 8.2% liveweight). At the 40% level, net protein retention (NPR) was highest on the dextrin diet and lowest on the glucose diet. At 10%, glucose spared more, and at 40%, spared less protein energy in the diet than dextrin, starch or sucrose at corresponding levels. The value of these carbohydrates for replacing protein energy in rations for tilapia is discussed. As *a*-cellulose was increased from 0% to 40% growth, food conversion efficiency (FCE), NPR, carcass fat and condition factor were reduced. Growth and FCE on the 25% and 40% *a*-cellulose diets was lower than the control. The use of *a*-cellulose as an inert bulker in experimental diets for fish is discussed.

84-001739 Burke, D. B. and W. R. Robison. WINTER FEEDING OF FINGERLING CHANNEL CATFISH IN CAGES. *Proc. Ark. Acad. Sci.* 35:82. 1981. SFA 29(3)
[Dep. Agric., Univ. Ark., Pine Bluff 71601]

84-001740 Dabrowski, K. INFLUENCE OF INITIAL WEIGHT DURING THE CHANGE FROM LIVE TO COMPOUND FEED ON THE SURVIVAL AND GROWTH OF FOUR CYPRINIDS. *Aquaculture* 40(1):27-40. 1 July 1984. SFA 29(3)
[Inst. Ichthyobiol. Fish., Acad. Agric. Technol., 10-957 Olsztyn-Kortowo, Poland]

84-001741 De Silva, S. S. and M. K. Perera. DIGESTIBILITY IN *SAROTHERODON NILOTICUS* FRY: EFFECT OF DIETARY PROTEIN LEVEL AND SALINITY WITH FURTHER OBSERVATIONS ON VARIABILITY IN DAILY DIGESTIBILITY. *Aquaculture* 38(4):293-306. 1 June 1984. SFA 29(3)
[Dep. Zool., Univ. Ruhuna, Meddawatte, Matara, Sri Lanka]

84-001742 Dendrinos, P.; S. Dewan and J. P. Thorpe. IMPROVEMENT IN THE FEEDING EFFICIENCY OF LARVAL, POST LARVAL AND JUEVNILE DOVER SOLE (*SOLEA SOLEA* L.) BY THE USE OF STAINING TO IMPROVE THE VISIBILITY OF *ARTEMIA* USED AS FOOD. *Aquaculture* 38(2):137-144. 1 May 1984. SFA 29(3)
[J. P. Thorpe: Dep. Mar. Biol., Univ. Liverpool, Mar. Biol. Stn., Port Erin, Isle of Man, U.K.] The feeding efficiency of larval, post larval and juvenile Dover sole (*Solea solea* L.) was studied by using *Artemia* stained with five different food colourings - brilliant blue, pink, lemon yellow, red "C" and black. The results show that the feeding efficiency is markedly improved by this treatment. The maximum feeding efficiency was found using black stained *Artemia* and minimum for the unstained control. This clearly suggests that the contrast perception of the food in relation to the illumination of the background is of major importance especially during the critical weaning period of the larval stage when feeding is being established.

FEEDS, FEEDING, AND NUTRITION (CONTINUED)

84-001743 Foltz, J. W. A FEEDING GUIDE FOR SINGLE-CROPPED CHANNEL CATFISH (*ICTALURUS PUNCTATUS*). *Proc. Annu. Meet. World Maricult. Soc.* 13:274-281. 1982. SFA 29(3)
[Dep. Entomol. Fish. Wildl., Clemson Univ., Clemson, SC 29631]

84-001744 Gropp, J.; H. Koops and K. Tiews. EFFICIENCY TEST OF SIX SELECTED EXPERIMENTALLY-DEVELOPED RAINBOW TROUT PELLET FEEDS AND FOUR COMMERCIAL FEEDS. *Arch. Fischereiwiss.* 34(2-3):175-182. Mar. 1984. In English with German summ. SFA 29(3)
[Inst. Physiol., Univ. München, München, West Germany]

84-001745 Harada, K. and I. Ikeda. FEEDING ATTRACTANTS IN CHEMICAL CONSTITUENTS OF LAKE PRAWN FOR ORIENTAL WEATHERFISH. *Bull. Jpn. Soc. Sci. Fish.* 50(4):617-622. Apr. 1984. SFA 29(3)
[Lab. Biochem., Dep. Food Sci. Technol., Shimonoseki Univ. Fish. Shimonoseki 759-65, Japan]

84-001746 Harada, K. and H. Matsuda. FEEDING ATTRACTANTS IN CHEMICAL CONSTITUENTS FROM THE MID-GUT GLAND OF SQUID FOR JUVENILE YELLOWTAIL. *Bull. Jpn. Soc. Sci. Fish.* 50(4):623-626. Apr. 1984. SFA 29(3)
[Lab. Biochem., Dep. Food Sci. Technol., Shimonoseki Univ. Fish., Shimonoseki 759-65, Japan]

84-001747 Hardy, R. W.; K. D. Shearer; F. E. Stone and D. H. Wieg. FISH SILAGE IN AQUACULTURE DIETS. *J. World Maricult. Soc.* 14:695-703. 1983. SFA 29(3)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112]

84-001748 Hardy, R. W.; K. D. Shearer and J. Spinelli. THE NUTRITIONAL PROPERTIES OF CO-DRIED FISH SILAGE IN RAINBOW TROUT (*SALMO GAIRDNERI*) DRY DIETS. *Aquaculture* 38(1):35-44. 15 Apr. 1984. SFA 29(3)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112]

84-001749 Helfrich, L. A.; J. C. Dean and D. L. Weigmann. GROWTH RESPONSE OF CAGE-CULTURED CHANNEL CATFISH FED TWO COMMERCIAL DIETS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 35:531-540. 1981. SFA 29(3)
[Dep. Fish. Wildl. Sci., VPI&SU, Blacksburg, VA 24061]

84-001750 Jackson, A. J.; A. K. Kerr and C. B. Cowey. FISH SILAGE AS A DIETARY INGREDIENT FOR SALMON. I. NUTRITIONAL AND STORAGE CHARACTERISTICS. *Aquaculture* 38(3):211-220. 15 May 1984. SFA 29(3)
[Dunstaffnage Mar. Res. Lab., P.O. Box 3, Oban, Argyll, Scotland]

84-001751 Lindsay, G. J. H.; M. J. Walton; J. W. Adron; T. C. Fletcher; C. Y. Cho and C. B. Cowey. THE GROWTH OF RAINBOW TROUT (*SALMO GAIRDNERI*) GIVEN DIETS CONTAINING CHITIN AND ITS RELATIONSHIP TO CHITINOLYTIC ENZYMES AND CHITIN DIGESTIBIILITY. *Aquaculture* 37(4):315-334. 1 Apr. 1984. SFA 29(3)
[N.E.R.C. Inst. Mar. Biochem., St. Fittick's Rd., Aberdeen AB1 3RA, Scotland]

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84-001752 Métailler, R.; M. Cadena-Roa and J. P. Ruyet. ATTRACTIVE CHEMICAL SUBSTANCES FOR THE WEANING OF DOVER SOLE (*SOLEA VULGARIS*): QUALITATIVE AND QUANTITATIVE APPROACH. *J. World Maricult. Soc.* 14:679-684. 1983. SFA 29(3)
[Cent. Oceanol. Bretagne, BP 337, 29273 Brest Cedex, France]

84-001753 Murray, R. L., Jr. and A. Mitsui. GROWTH OF HYBRID TILAPIA FRY FED NITROGEN FIXING MARINE BLUE-GREEN ALGAE IN SEAWATER. *Proc. Annu. Meet. World Maricult. Soc.* 13:198-209. 1982. SFA 29(3)
[Univ. Miami Sch. Mar. Atmos. Sci., 4600 Rickenbacker Causeway, Miami, FL 33149]

84-001754 Newton, S. H. and W. R. Robison. RATION/DENSITY COMPARISONS WITH CAGED CHANNEL CATFISH. *Proc. Ark. Acad. Sci.* 35:89-90. 1981. SFA 29(3)
[Dep. Agric., Univ. Ark., Pine Bluff 71601]

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[Jpn. Mar. Sci. Technol. Cent., Natsushima, Yokosuka 237, Japan]

84-001756 Roa, M. C.; C. Huelvan; Y. L. Borgne and R. Métailler. USE OF REHYDRATABLE EXTRUDED PELLETS AND ATTRACTIVE SUBSTANCES FOR THE WEANING OF SOLE (*SOLEA VULGARIS*). *Proc. Annu. Meet. World Maricult. Soc.* 13:246-253. 1982. SFA 29(3)
[Cent. Oceanol. Bretagne, BP 337, 29273 Brest Cedex, France]

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[Dep. Wildl. Fish. Sci., Tex. A&M Univ., College Station 77843]

84-001758 Ruyet, J. P. and T. Noël. EFFECTS OF MOIST PELLETED FOODS ON THE GROWTH OF HATCHERY TURBOT (*SCOPHTHALMUS MAXIMUS*) JUVENILES. *Proc. Annu. Meet. World Maricult. Soc.* 13:237-245. 1982. SFA 29(3)
[Cent. Oceanol. Bretagne, BP 337, 29273 Brest Cedex, France]

84-001759 Ruyet, J. P.; B. Menu; M. Cadena-Roa and R. Métailler. USE OF EXPANDED PELLETS SUPPLEMENTED WITH ATTRACTIVE CHEMICAL SUBSTANCES FOR THE WEANING OF TURBOT (*SCOPHTHALMUS MAXIMUS*). *J. World Maricult. Soc.* 14:676-678. 1983. SFA 29(3)
[Cent. Oceanol. Bretagne, BP 337, 29273 Brest Cedex, France]

84-001760 Saroglia, M. G. and G. Scarano. FABBISOGNO DI VITAMINA C NELLA DIETA DI SPIGOLA (*DICENTRARCHUS LABRAX*) ALLEVATA IN ACQUA DI MARE. [THE VITAMIN C REQUIREMENT IN THE DIET OF THE SEA BASS (*DICENTRARCHUS LABRAX*)

FEEDS, FEEDING, AND NUTRITION (CONTINUED)

84-001760 CONTINUED FARMED IN MARINE WATER.] *Riv. It. Piscic. Itciop.* 19(1):4-11. 1984. In English and Italian. SFA 29(3)
[ENEL, Cent. Ricerca Termica Nucleare, Via Rubattino 54, Milano, Italy]

84-001761 Stickney, R. R. and R. B. McGeachin. TISSUE LIPID AND FATTY ACID CHANGES IN CHANNEL CATFISH (*ICTALURUS PUNCTATUS*) FRY FED A FAT-FREE DIET. *Tex. J. Sci.* 36(1):65-71. Mar. 1984. SFA 29(3)
[Dep. Wildl. Fish. Sci., Tex. A&M Univ., College Station 77843]

84-001762 Takeda, M.; K. Takii and K. Matsui. IDENTIFICATION OF FEEDING STIMULANTS FOR JUVENILE EEL. *Bull. Jpn. Soc. Sci. Fish.* 50(4):645-651. Apr. 1984. SFA 29(3)
[Fac. Agric., Kochi Univ., Nankoku 783, Japan]

84-001763 Viola, S. and G. Zohar. NUTRITION STUDIES WITH MARKET SIZE HYBRIDS OF TILAPIA (*OREOCHROMIS*) IN INTENSIVE CULTURE. 3. PROTEIN LEVELS AND SOURCES. *Bamidgeh* 36(1):3-15. Mar. 1984. SFA 29(3)
[Miloubar, D.N. Ashrat 25201, Israel]

84-001764 Waas, B. P. and K. Strawn. EVALUATION OF SUPPLEMENTAL DIETS FOR POND CULUTRE OF GULF KILLIFISH (*FUNDULUS GRANDIS*) FOR THE LIVE BAIT INDUSTRY. *Proc. Annu. Meet. World Maricult. Soc.* 13:227-236. 1982. SFA 29(3)
[Dep. Wildl. Fish. Sci., Tex. A&M Univ., College Station 77843] Juvenile *Fundulus grandis* averaging 0.5 g/fish were stocked into 8 0.1 ha brackish water earthen ponds at 200,000/ha. Growth was monitored over a 70-day period (from June 9 to August 18, 1980) and fish were offered at 5% body weight per day either commercial trout feed (40% protein), commercial minnow meal (33% protein) or a 1:1 mixture of cotton seed meal and wheat shorts (32% protein). There was no significant difference in growth rates between fish fed the low cost 1:1 mix and the more expensive trout feed, but growth of fish fed minnow feed was significantly lower. Production averaged 565, 554, and 497 kg/ha for the 1:1 mix, trout feed and minnow feed, respectively, with corresponding food conversion ratios of 1.8, 1.86 and 2.07. Survival ranged from 80 to 92% and 88% of all the fish reached ideal marketable size (62.5 ± 7.5 mm TL) while 99% were distributed within a range of 50-75 mm. This species is sold by the dozen and high survival plus relatively low food cost for those offered minow meal resulted in the highest return above feed costs.

84-001765 Watanabe, T.; S. Ohhashi; A. Itoh; C. Kitajima and S. Fujita. EFFECT OF NUTRITIONAL COMPOSITION OF DIETS AND CHEMICAL COMPONENTS OF RED SEA BREAM BROODSTOCK AND EGGS PRODUCED. *Bull. Jpn. Soc. Sci. Fish.* 50(3):503-515. Mar. 1984. SFA 29(3)
[Lab. Fish Nutr., Tokyo Univ. Fish., Konan 4, Minato, Tokyo 108, Japan]

84-001766 Watanabe, T.; T. Arakawa; C. Kitajima and S. Fujita. EFFECT OF NUTRITIONAL QUALITY OF BROODSTOCK DIETS ON REPRODUCTION OF RED SEA BREAM. *Bull. Jpn. Soc. Sci. Fish.* 50(3):495-501. Mar. 1984. SFA 29(3)
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[Dep. Biol., Chinese Univ. Hong Kong, Shatin, Hong Kong]

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[Steinhart Aquarium, Calif. Acad. Sci., San Francisco]

84-001770 Maran, L. and P. Maran. OUR METHOD FOR BREEDING AND RAISING PLATIES. *Trop. Fish Hobbyist* 32(12):10-33. Aug. 1984. SFA 29(3)

MISCELLANEOUS CULTURE TECHNIQUES AND EQUIPMENT

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84-001772 Ibrahim, A.; C. Shimizu and M. Kono. PIGMENTATION OF CULTURED RED SEA BREAM, *CHRYSOPHRYS MAJOR*, USING ASTAXANTHIN FROM ANTARCTIC KRILL, *EUPHAUSIA SUPERBA*, AND A MYSID, *NEOMYSIS* SP. *Aquaculture* 38(1):45-57. 15 Apr. 1984. SFA 29(3)
[Fish. Res. Lab., Fac. Agric., Univ. Tokyo, Maisaka Hamana-gun, Shizuoka Pref., 431-02, Japan]

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[Dep. Fish., P.O. Box 699, Haifa 31000, Israel] Experiments were conducted to determine the adaptability of the guppy to various salt concentrations. The guppy, *Poecilia reticulata*, (total Length 11-40mm) were subjected to abrupt and gradual changes from fresh water (salinity = 0.1 0/00) to various salinities (0/00). No mortality occurred when the fish were transferred from fresh water to 50% sea water (19.5 0/00). Through gradual adaptation from 50% sea water to 80% of the fish were able to tolerate 100% (39 0/00) sea water for 7 days. After a 7 day stay in sea water, fish were readapted to fresh water during a 3 h period. Through gradual adaptation fish were also able to tolerate salinities ranging from 39.0 0/00 (100% sea water) to 58.5 0/00. After a 30 day stay in 150% sea water (58.5 0/00), fish were readapted to fresh water over a 5 h period. The results indicate that they were well able to tolerate the abrupt change form 100 or 150% sea water to fresh water. Females that stayed in 150% sea water (58.5 0/00) for 30 days had embryos in their gonads.

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[Lab. Nutr. Elevage Poissons, I.N.R.A., Saint Pée-sur-Nivelle, 64310 Ascain, France] Patterns of oxygen consumption, ammonia and urea excretion were monitored during late embryogenesis, i.e. 5 days before mass hatching and 12 days during the free-swimming stage of whitefish larvae, *Coregonus lavaretus*. Oxygen consumption increased from 1.31 to 2.53 mg $O_2 h^{-1} x 10^3$ eggs at hatching when it reached 5.52 mg $O_2 h^{-1} x 10^3$ larvae^{-1}. Ammonia and urea excretion increased during pre-hatching period from 52.1 to 163.2 and 26.8 to 51.4 µg $h^{-1} x 10^3$ eggs^{-1}, respectively. The nitrogen excretion rate increased between the sixth and tenth day of fasting, i.e. for ammonia from 117.7 to 160.9 and for urea from 35.8 to 52.5 µg h^{-1} $x10^3$ larvae^{-1}. Cumulative data on nitrogen and energy metabolism indicated that during late embryogenesis, and up to the fifth day after hatching, protein dominated in the energy expenditure. During the free swimming stage, the ratio of fat to protein in energy expenditure rose from 0.86 to 1.99. Combined data for several fish species indicated high dependance of oxygen uptake during the hatching period on egg size and temperature.

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[Oreg. Coop. Fish. Res. Unit, Oreg. State Univ., 104 Nash Hall, Corvallis 97331] Analysis of stomach contents of *Stegastes lividus* revealed a shift from omnivory in juveniles to herbivory in adults. Red algae, primarily

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84-002017 Chrisman, C. L.; W. R. Wolters and G. S. Libey. TRIPLOIDY IN CHANNEL CATFISH. *J. World Maricult. Soc.* 14:279-293. 1983. SFA 29(3)
[Dep. Anim. Sci., Purdue Univ., West Lafayette, IN 47907] Triplody was induced in channel catfish (*Ictalurus punctatus*) by hand stripping eggs from gravid females, fertilization with minced testes from donor males, and cold shocking the eggs at 5°C for one hour beginning 5 minutes post-fertilization. Hatching success of eggs cold shocked for one hour was 79% compared to 89% in controls. Cold shocks longer than one hour caused 100% mortality. Cytogenetic observations through lymphocyte cultures and direct processing of mitotic cells from kidney tissue confirmed that all controls were diploid (2n=58 chromsomes) and 100% of the one-hour cold shocked treatment group were triploid (3n=87 chromsomes). Full sibling diploid and triploid channel catfish were reared in round 870-liter fiberglass tanks indoors with water supply, filtration, and disease treatment common to both tanks. All fish were fed 4 times daily to satiation for the first month, twice daily to 8 months, then once daily thereafter with appropriately sized trout rations (35% protein). Triploids were significantly heavier at 8 months of age and older stages than the diploids (92.9±0.98 g vs 87.8±1.09 g at 8 months) and converted feed more efficiently (1.19 kg feed per kg of gain in triploids vs 1.3 in diploids). Histological analysis of ovaries and testes from 54 fish representing both ploidy levels confirmed that almost complete lack of sexual development characteristic of many triploid organisms.

84-002018 Crandall, P. S. and P. P. Durocher. COMPARISON OF GROWTH RATES, SEX RATIOS, REPRODUCTIVE SUCCESS AND CATCHABILITY OF THREE SUNFISH HYBRIDS. *Annu. Proc. Tex. Chap. Am. Fish. Soc.* 2:88-104. 1980. SFA 29(3)
[Tex. Parks Wildl. Dep., Ingram 78025] Hybrid sunfish, male bluegill (*Lepomis macrochirus purpurescens*) x female green (*Lepomis cyanellus*), male bluegill x female redear (*Lepomis microlophus*), and male green x female redear were stocked in ponds and their growth, sex ratios, reproductive success, and catchability compared. Bluegill x green and green x redear hybrids exhibited the fastest growth with bluegill x green showing the best overall growth and condition. All three hybrids were predominantly males. Reproduction occurred, but appeared to be less than that of parent species. Bluegill x green hybrids were the easiest to catch on baits tested.

84-002019 Danzmann, R. G.; M. M. Ferguson and F. W. Allendorf. DEVELOPMENTAL RATE AND HETEROZYGOSITY AT MDH-3,4 IN RAINBOW TROUT. *Genetics* 107(3, part 2):s24. 1984. Abstract only. SFA 29(3)
[Univ. Mont., Missoula]

84-002020 De Panepucci, L. L. L.; M. L. B. Schwantes and A. R. Schwantes. LOCI THAT ENCODE THE LACTATE DEHYDROGENASE IN 23 SPECIES OF FISH BELONGING TO THE ORDERS CYPRINIFORMES, SILURIFORMES AND PERCIFORMES: ADAPTATIVE FEATURES. *Comp. Biochem. Physiol. B Comp. Biochem.* 77(4):867-876. 1984. SFA 29(3)
[Univ. Fed. São Carlos, Dep. Ciênce. Biol., Caixa Postal 676, 13560 São Carlos SP, Brazil]

84-002021 Delany, M. E. and S. E. Bloom. REPLICATION BANDING PATTERNS IN THE METAPHASE CHROMOSOMES OF RAINBOW TROUT. *Genetics* 107(3, part 2):s25. 1984. Abstract only. SFA 29(3)
[Cornell Univ., Ithaca, NY]

GENETICS, VARIATION STUDIES AND HYBRIDIZATION (CONTINUED)

84-002022 Dunham, R. A.; R. O. Smitherman; J. A. Chappell; P. N. Youngblood and T. O. Bice. COMMUNAL STOCKING AND MULTIPLE REARING TECHNIQUE FOR CATFISH GENETICS RESEARCH. *Proc. Annu. Meet. World Maricult. Soc.* 13:261-267. 1982. SFA 29(3)
[Ala. Agric. Exp. Stn., Auburn Univ., Auburn 36849]

84-002023 Farr, J. A. and K. Peters. THE INHERITANCE OF QUANTITATIVE FITNESS TRAITS IN GUPPIES, *POECILIA RETICULATA* (PISCES: POECILIIDAE). II. TESTS FOR INBREEDING EFFECTS. *Heredity* 52(2):285-296. Apr. 1984. SFA 29(3)
[Dep. Biol. Sci., Fla. State Univ., Talahassee 32306]

84-002024 Golubtsov, A. S. and I. I. Il'in. PROTEIN ELECTROPHORESIS OF BREAM, *ABRAMIS BRAMA*, AND WHITE BREAM, *BLICCA BJOERKNA* (CYPRINIDAE) FROM MOZHAYSK RESERVOIR. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 23(4):101-110. 1983. SFA 29(3)
[Moscow State Univ., Moscow, USSR]

84-002025 Gorshkova, G. V. and S. A. Gorshkov. CHROMOSOMAL POLYMORPHISM OF THE HUMPBACK SALMON IN EVEN AND ODD YEARS. *Dokl. Biol. Sci.* (Engl. Transl. Dokl. Akad. Nauk SSSR) 273(1-6):750-753. May 1984. SFA 29(3)
[Pac. Ocean Sci.-Res. Inst. Fish. Oceanogr., Petropavlovsk-Kamchatka, USSR]

84-002026 Grant, W. S. BIOCHEMICAL POPULATION GENETICS OF ATLANTIC HERRING, *CLUPEA HARENGUS*. *Copeia* 1984(2):357-364. 1 May 1984. SFA 29(3)
[Dep. Microbiol., Univ. Cape Town, Rondebosch, 7700, South Africa]

84-002027 Harvey, W. D.; I. F. Greenbaum and R. L. Noble. ELECTROPHORETIC EVALUATION OF FIVE HATCHERY STOCKS OF LARGEMOUTH BASS IN TEXAS. *Annu. Proc. Tex. Chap. Am. Fish. Soc.* 3:49-63. 1981. SFA 29(3)
[Dep. Wildl. Fish. Sci., Tex. A&M Univ., College Station 77843]

84-002028 Hashimoto, K.; S. Watabe; T. Nakagawa and K. Sorita. [ELECTROPHORETIC IDENTIFICATION OF THREE SUBSPECIES OF THE GENUS *LAGOCEPHALUS* PUFFERFISH.] *Bull. Jpn. Soc. Sci. Fish.* 50(1):115-118. Jan. 1984. In Japanese with English summ. SFA 29(3)
[Lab. Mar. Biochem., Fac. Agric., Univ. Tokyo, Bunkyo, Tokyo 113, Japan]

84-002029 Johnson, A. D. A GENETIC COMPARISON OF FIVE HATCHERY STRAINS OF RAINBOW TROUT (*SALMO GAIRDNERI*) BASED ON ELECTROPHORETIC DATA. *Tenn. Tech. J.* 18:61. 1983. Abstract only. SFA 29(3)

84-002030 Johnson, K. R. and J. E. Wright, Jr. LINKAGE MAPS IN TETRAPLOID SALMONID FISHES. *Genetics* 107(3, part 2):s53. 1984. Abstract only. SFA 29(3)
[Pa. State Univ., University Park]

GENETICS, VARIATION STUDIES AND HYBRIDIZATION (CONTINUED)

84-002031 Junbao, S.; F. Zhaoting; L. Suwen; C. Ruxuan and X. Shaobai. COMPARATIVE STUDIES OF THE SOMATIC CELL AND SPERMATOZOON DNA CONTENTS AND PLOIDY OF FANGZHENG CRUCIAN CARP AND ZHA-LONG LAKE GOLDFISH. *Acta Zool. Sin.* 30(1):7-13. 1984. SFA 29(3)
[Herlongjiang Fish. Res. Inst., Chinese Acad. Aquatic Sci., Harbin, China]

84-002032 Kallman, K. D. SEX RATIO AND THE GENETICS OF SEX DETERMINATION IN SWORDTAILS, *XIPHOPHORUS* POECILIIDAE *Genetics* 107(3, part 2):s54. 1984. Abstract only. SFA 29(3)
[Zool. Soc., Brooklyn, NY]

84-002033 Kijima A. and Y. Fujio. RELATIONSHIP BETWEEN AVERAGE HETEROZYGOSITY AND RIVER POPULATION SIZE IN CHUM SALMON. *Bull. Jpn. Soc. Sci. Fish.* 50(4):603-608. Apr. 1984. SFA 29(3)
[Dep. Cult. Fish., Fac. Agric., Kochi Univ., Nankoku 783, Japan]

84-002034 Knudsen, K. L.; R. F. Leary and M. Talluri. REDUCED DEVELOPMENTAL STABILITY OF NULL ALLELE HETEROZYGOTES AT TWO LACTATE DEHYDROGENASE LOCI IN RAINBOW TROUT. *Genetic* 107(3, part 2):s57. 1984. Abstract only. SFA 29(3)
[Univ. Mont., Missoula]

84-002035 Lou, Y. D. and C. E. Purdom. DIPLOID GYNOGENESIS INDUCED BY HYDROSTATIC PRESSURE IN RAINBOW TROUT, *SALMO GAIRDNERI* RICHARDSON. *J. Fish Biol.* 24(6):665-670. June 1984. SFA 29(3)
[Dep. Aquacult., Shanghai Fish. Coll., China] Diploid gynogenetic fry of rainbow trout, *Salmo gairdneri*, were produced by treating eggs activated by UV-irradiated sperm with hydrostatic pressure. Treatments for 10 min at 40 min after activation with 55 000 kPa (8000 psi) pressure resulted in high hatching rates and yields of heterozygous diploid gynogenomes of up to 81%. Attempts to produce homozygous diploid gynogenomes by the suppression of the first mitotic division of the eggs failed. Ether treatment alone did not induce diploid gynogenesis.

84-002036 Malone, J. M. 100% TRIPLOID GRASS CARP. *Farm Pond Harvest* 18(3):19-20. 1984. SFA 29(3)

84-002037 Osinov, A. G.; E. D. Vasil'eva and V. P. Vasil'ev. HYBRID ORIGIN OF THE UNISEXUAL TRIPLOID FORM OF THE GENUS *COBITIS* (COBITIDAE, PISCES). *Dokl. Biol. Sci. (Engl. Transl. Dokl. Akad. Nauk SSSR)* 272(1-6):554-556. Sept.-Oct. 1983. SFA 29(3)
[M.V. Lomonosov Moscow State Univ., Moscow, USSR]

84-002038 Pasdar, M.; D. P. Philipp and G. S. Whitt. LINKAGE RELATIONSHIPS OF NINE ENZYME LOCI IN SUNFISHES (LEPOMIS; CENTRARCHIDAE). *Genetics* 107(3):435-446. July 1984. SFA 29(3)
[Dep. Genet. Dev., Univ. Ill., Urbana 61801]

GENETICS, VARIATION STUDIES AND HYBRIDIZATION (CONTINUED)

84-002039 Phillips, R. B. and P. E. Ihssen. CHROMOSOME BANDING DIFFERENCE BETWEEN THE X AND Y CHROMOSOMES OF LAKE TROUT. *Genetics* 107(3, part 2):s82-s83. 1984. Abstract only. SFA 29(3)
[Univ. Wis., Milwaukee]

84-002040 Robison, O. W. and L. G. Luempert III. GENETIC VARIATION IN WEIGHT AND SURVIVAL OF BROOK TROUT (*SALVELINUS FONTINALIS*). *Aquaculture* 38(2):155-170. 1 May 1984. SFA 29(3)
[Dep. Anim. Sci., N.C. State Univ., Raleigh 27650] Data were from brook trout (*Salvelinus fontinalis*) where four males were mated to four females in a diallel mating scheme, replicated eight times. Heritabilities computed from the sire component were 0.08 for 144 day weight and 0.60 for 243 day weight while those from the dam component were 0.34 and 0.37, respectively. Maternal variance decreased from 6% of total variance at 144 days to -6% at 243 days. Non-additive genetic variance was high at both ages. Heritabilitites were estimated for cummulative survival at eight developmental stages. Heritabilities based on the sire component were low at early stages and decreased with time. Heritabilities based on the dam component were higher but follwed the same pattern. Maternal variance accounted for approximately 11% of total variance at all stages except fertilization. Non-additive genetic variance was of considerable importance for all stages except fertilization. Heritabilities for survival between 144 days and 243 days were moderate (0.16 to 0.51). Low positive genetic correlations of 144 day weight with survival were obtained. Negative correlations between 243 day weight and survival suggest that selection for increased 243 day weight would indirectly select against survival. However, a moderate correlation between egg weight and 243 day survival, and a low, but positive correlation between egg weight and 243 day weight suggests that selecting heavier eggs would improve both weight and survival.

84-002041 Schom, C. B.; M. S. Miles; R. I. G. Morgan; J. E. Thorpe and R. Alderson. NORTH AMERICAN AND EUROPEAN ATLANTIC SALMON *(SALMO SALAR). Genetics* 107(3, part 2):s96. 1984. Abstract only. SFA 29(3)
[Univ. New Brunswick, St. John, NB, Canada]

84-002042 Sevenster, P. and T. C. M. Bakker. GENETIC FACTORS IN AGGRESSIVE BEHAVIOR OF STICKLEBACKS *(GASTEROSTEUS ACULEATUS L.). Aggressive Behav.* 10(2):172. 1984. Abstract only. SFA 29(3)
[Dep. Ethol., Univ. Leiden, Kaiserstr. 63/2300 RA Leiden, Netherlands]

84-002043 Smith, M. C. GENETIC DIVERSITY WITHIN AND AMONG SEVERAL KILLIFISH SPECIES *(FUNDULUS). Bull. Ecol. Soc. Am.* 62(2):85. June 1981. Abstract only. SFA 29(3)
[Univ. Houston, Houston, TX]

84-002044 Thorgarrd, G. H.; P. D. Scheerer and J. E. Parsons. RESIDUAL PATERNAL INHERITANCE IN GYNOGENETIC RAINBOW TROUT. *Genetics* 107(3, part 2):s106. 1984. Abstract only. SFA 29(3)
[Wash. State Univ., Pullman]

84-002045 Tikjomirova, G. I. [ISOZYME SPECTRA AND INHERITANCE OF ELECTROPHORETIC VARIANTS OF PHOSPHOGLUCOMUTASE IN THE CARP (*CYPRINUS CARPIO* L.).] *Genetika* 20(5):821-825. 1984. In Russian with English summ. SFA 29(3)
[Inst. Cytol., Acad. Sci. USSR, Leningrad, USSR]

GENETICS, VARIATION STUDIES AND HYBRIDIZATION (CONTINUED)

84-002046 Torrissen, O. J. and G. Naevdal. PIGMENTATION OF SALMONIDS--GENETICAL VARIATION IN CAROTENOID DEPOSITION IN RAINBOW TROUT. *Aquaculture* 38(1):59-66. 15 Apr. 1984. SFA 29(3)
[Inst. Mar. Res., Matre Aquacult. Stn., 5198 Matredad, Norway]

84-002047 Turner, B. J. EVOLUTIONARY GENETICS OF ARTIFICIAL REFUGIUM POPULATIONS OF AN ENDANGERED SPECIES, THE DESERT PUPFISH. *Copeia* 1984(2):364-369. 1 May 1984. SFA 29(3)
[Dep. Biol., VPI&SU, Blacksburg, VA 24061] Four artificial refugium populations of an endangered fish species, *Cyprinodon macularius*, the desert pupfish, were surveyed for allozyme variation at the products of 39 presumptive structural gene loci; they were then compared to five remnant natural populations of the same species. Although some divergences in specific allele frequencies in the refugium populations were detected, comparison revealed little overall divergence between the refugium populations and their natural progenitors. In addition, there was no apparent loss of average genic heterozygosity in the refugium populations. Apparently, neither bottlenecks nor genetic drift subsequent to founding have had a profound influence on the variation of the refugium populations. The operation of some form of stabilizing natural selection in the refugia is suspected, but its mode of action is obscure. These results suggest that artificial refugia for endangered fish species are a biologically valid component of their management and conservation.

84-002048 Ueda, T. and Y. Ojima. GEOGRAPHIC AND CHROMOSOMAL POLYMORPHISMS IN THE IWANA *(SALVELINUS LEUCOMAENIS)*. *Proc. Jpn. Acad. B Phys. Biol. Sci.* 59(8):259-262. Oct. 1983. SFA 29(3)
[Dep. Biol., Fac. Educ., Utsunomiya Univ., Utsunomiya 321, Japan]

84-002049 Vasiliev, V. P.; E. D. Vasilieva; V. N. Ivanov and K. V. Bulatov. [AN ANALYSIS OF NATURAL HYBRIDIZATION IN THE CENTRACANTHIDAE (PISCES, PERCIFORMES) FROM THE BLACK SEA.] *Zool. Zh.* 63(4):554-562. 1984. In Russian with English summ. SFA 29(3)
[Inst. Anim. Evol. Morphol. Ecol., USSR Acad. Sci., Moscow, USSR]

84-002050 Vuorinen, J. DUPLICATE LOCI FOR SUPERNATANT AND MITOCHONDRIAL MALIC ENZYMES IN VENDACE, *COREGONUS ALBULA* (L.). *Comp. Biochem. Physiol. B Comp. Biochem.* 78(1):63-66. 1984. SFA 29(3)
[Dep. Biol., Univ Joensuu, P.O. Box 111, SF-80101 Joensuu, Finland]

84-002051 Yabu, H. and K. Ishii. CHROMOSOMES OF THE GREAT BLUE SHARK *PRIONACE GLAUCA* (LINNAEUS). *Bull. Jpn. Soc. Sci. Fish.* 50(1):7-10. Jan. 1984. SFA 29(3)
[Fac. Fish., Hokkaido Univ., 1-1, Minato-3, Hakodate 041, Japan]

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84-002052 Allen, E. E. SPECTRAL SENSITIVITY IN *HAPLOCHROMIS BURTONI* (CICHLIDAE). *Ph.D. dissertation, Univ Oreg.* 185p. 1983. From Diss. Abstr. Int. B Sci. Eng. 44(11):3314. May 1984. SFA 29(3)

BEHAVIOR (CONTINUED)

84-002053 Batty, R. S. DEVELOPMENT OF SWIMMING MOVEMENTS AND MUSCULATURE OF LARVAL HERRING (*CLUPEA HARENGUS*). *J. Exp. Biol.* 110:217-229. May 1984. SFA 29(3)
[Scott. Mar. Biol. Assoc., Dunstaffnage Mar. Res. Lab., P.O. Box 3, Oban, Argyll, Scotland]

84-002054 Becker, L. R., Jr. SEASONALITY OF HABITAT DISTRIBUTION OF CATOSTOMID FISH IN THE ALLEGHANY RIVER VALLEY, NEW YORK. *Bull. Ecol. Soc. Am.* 62(2):85. June 1981. Abstract only. SFA 29(3)
[Environmental Consultants, Inc., Olean, NY]

84-002055 Block, C. J.; J. R. Spotila; E. A. Standora and J. W. Gibbons. BEHAVIORAL THERMOREGULATION OF LARGEMOUTH BASS, *MICROPTERUS SALMOIDES*, AND BLUEGILL, *LEPOMIS MACROCHIRUS*, IN A NUCLEAR REACTOR COOLING RESERVOIR. *Environ. Biol. Fishes* 11(1):41-52. 15 June 1984. SFA 29(3)
[J. R. Spotila: Dep. Biol., State Univ. Coll. Buffalo, 1300 Elmwood Ave., Buffalo, NY 14222]

84-002056 Block, C. J.; J. R. Spotila; E. A. Standora and J. W. Gibbons. BEHAVIORAL THERMOREGULATION OF LARGEMOUTH BASS *(MICROPTERUS SALMOIDES)* IN A NUCLEAR REACTOR COOLING RESERVOIR. *Bull. Ecol. Soc. Am.* 63(2):126. June 1982. Abstract only. SFA 29(3)
[State Univ. Coll., Buffalo, NY] Behavioral mechanisms which allow largemouth bass to survive under adverse temperature conditions were examined. Bass were restricted in range by lethal water temperature, utilizing a greater portion of the reservoir in winter than summer. Under unheated conditions, bass occupied shallow areas with an abundance of structure, a deep area with springs, and the cove where the effluent canal entered the reservoir. Commencement of reactor operation resulted first in increased water flow into the reservoir and then an increase in water temperature (>50° in summer). Bass retreated to three refuges and remained there until the reactor shut down and the reservoir cooled to normal. In the refuges bass experienced a wide variety of temperatures, but adults generally avoided temperatures above 31°C. Large Adult bass (>40 cm) occupied particular positions in a refuge cove, medium size bass (15-40 cm) swam in the open water, and small (<15 cm) occupied shallow water near shore where temperatures were 30-34°C.

84-002057 Bryant, B. P. THE ROLE OF CONSPECIFIC CHEMICAL STIMULI IN THE SOCIAL BEHAVIOR OF THE BROWN BULLHEAD, *ICTALURUS NEBULOSUS*. *Ph.D. dissertation, Boston Univ.* 146p. 1984. From Diss. Abstr. Int. B Sci. Eng. 44(11):3326. May 1984. SFA 29(3)

84-002058 Daley, D. M.; J. S. Griffith; R. L. Wallace and P. J. Connolly. RELATIVE ABUNDANCE AND HABITAT PREFERENCE OF THE SHOSHONE SCULPIN (*COTTUS GREENEI*). *Proc. Annu. Conf. West. Assoc. Fish Wildl. Agencies* 62:601-610. 1982. SFA 29(3)
[Dep. Biol., Idaho State Univ., Pocatello 83209]

84-002059 Daniel, T. L. UNSTEADY ASPECTS OF AQUATIC LOCOMOTION. *Am. Zool.* 24(1):121-134. 1984. SFA 29(3)
[Dep. Zool., Univ. Wash., Seattle 98250]

BEHAVIOR (CONTINUED)

84-002060 Døving, K. B.; B. Jonsson and L. P. Hansen. THE EFFECT OF ANOSMIA ON THE MIGRATION OF ATLANTIC SALMON SMOLTS (*SALMO SALAR* L.) IN FRESHWATER. *Aquaculture* 38(4):383-386. 1 June 1984. SFA 29(3)
[Dep. Zoophysiol., Univ. Oslo, P.O. Box 1051, Blindern, N-Oslo 3, Norway] Wild and hatchery-reared salmon smolts of the Imsa strain were divided into two groups. One group was made anosmic by cutting the olfactory nerves, the other served as control. The smolts were released at three different sites in the Ims-Lutsi watercourse and recaptured in a fish trap at 100 m above the river estuary. The recapture rates in the trap decreased with increasing migratory distance for the smolts. The experiment indicates that the olfactory sense in not essential for smolt navigation through rivers and lakes.

84-002061 Felley, J. D. MULTIVARIATE IDENTIFICATION OF MORPHOLOGICAL-ENVIRONMENTAL RELATIONSHIPS WITHIN THE CYPRINIDAE (PISCES). *Bull. Ecol. Soc. Am.* 62(2):85-86. June 1981. Abstract only. SFA 29(3)
[Rutgers Univ., New Brunswick, NJ]

84-002062 Fernald, R. D. VISION AND BEHAVIOR IN AN AFRICAN CICHLID FISH. *Am. Sci.* 72(1):58-65. Jan.-Feb. 1984. SFA 29(3)
[Inst. Neurosci., Univ. Oreg., Eugene 97403]

84-002063 Floyd, K. B.; R. D. Hoyt and S. Timbrook. CHRONOLOGY OF APPEARANCE AND HABITAT PARTITIONING BY STREAM LARVAL FISHES. *Trans. Am. Fish. Soc.* 113(2):217-223. Mar. 1984. SFA 29(3)
[Dep. Biol., West. Ky. Univ., Bowling Green 42101]

84-002064 Franck, D. THE EFFECT OF SOCIAL STIMULI ON STEROID LEVELS AND ATTACK READINESS IN MALE CICHLIDS AND SWORDTAILS. *Aggressive Behav.* 10(2):154. 1984. Abstract only. SFA 29(3)
[Zool. Inst., Univ. Hamburg, West Germany]

84-002065 Graham, J. H. and R. W. Hastings. DISTRIBUTIONAL PATTERNS OF SUNFISHES ON THE NEW JERSEY COASTAL PLAIN. *Environ. Biol. Fishes* 10(3):147-148. 14 Apr. 1984. SFA 29(3)
[Dep. Biol. Sci., Rutgers Univ., Piscataway, NJ 08854] Sunfishes of the genera *Lepomis* and *Enneacanthus* are characteristic inhabitants of quiet waters on the New Jersey coastal plain. In southern New Jersy, *E. chaetodon* and *E. obesus* are now almost totally restricted to the Pine Barrens region of the Outer Coastal Plain. In contrast, *E. gloriosus* is widely distributed. *Lepomis gibbosus* and *L. macrochirus* are also widespread, but have established few populations in the more acidic waters of the Pine Barrens. Factor analysis was used to determine underlying patterns of distribution among these 5 species, using 6 habitat variables, measured over 54 collection sites in New Jersey. Two general factors account for 41% of the distributional variation. Habitat variables most strongly associated with factor 1 suggest an underlying trophic gradient (dystrophy to eutrophy) with its associated species. Factor 2 suggests an underlying current-bottom gradient. The basis for the scarcity of *Lepomis* spp. from acidic waters was explored by examining the tolerance of recently hatched embryos to reduced pH. No increase in mortality was observed at pH 4.25 for *L. gibbosus* eleutheroembryos and pH 4.5 for *L. macrochirus* eleutheroembryos. The two species appear to be poorly suited to dystrophic habitats; young *Lepomis* are primarily planktivores, a dietary niche that is conspicuously reduced in dystrophic waters. Fish of the genus *Enneacanthus* glean invertebrates on substrate or vegetation, a behavior

BEHAVIOR (CONTINUED)

84-002065 CONTINUED well suited for dystrophic habitats where most primary and secondary production is associated with aquatic macrophytes and substrate.

84-002066 Grant, J. W. A. and P. W. Colgan. TERRITORIAL BEHAVIOUR OF THE MALE JOHNNY DARTER, *ETHEOSTOMA NIGRUM*. *Environ. Biol. Fishes* 10(4):261-269. 30 May 1984. SFA 29(3)
[Dep. Zool., Univ. Guelph, Guelph, ON NIG 2W1, Canada]

84-002067 Hagedorn, M. M. SOCIAL SIGNALS IN ELECTRIC FISH. *Ph.D. dissertation, Univ. Calif. (San Diego)* 161p. 1983. From Diss. Abstr. Int. B Sci. Eng. 44(11):3327. May 1984. SFA 29(3)

84-002068 Hassler, T. J. and S. T. Kucas. ARTIFICIAL IMPRINTING OF SALMON IN AN ANADROMOUS FISH HATCHERY. *Proc. Annu. Conf. West. Assoc. Fish Wildl. Agencies* 62:448-456. 1982. SFA 29(3)
[Calif. Coop. Fish. Res. Unit, Humboldt State Univ., Arcata 95521] Juvenile salmon were imprinted and later attracted, when they return to fresh water, with the artificial attractant morpholine. Coho salmon (*Oncorhynchus kisutch*) of the 1977 and 1978 brood years and chinook salmon (*O. tshawytscha*) of the 1977 and 1979 brood years from the Mad River Hatchery (California) were each divided into two groups - treated and control. The treated groups were exposed to $5x10^{-5}$mg/l of morpholine for at least 17 days prior to release. Both groups were fin clipped or nose tagged. Morpholine was metered into the hatchery's fish ladder during the spawning migration. Hatchery returns were monitored during the 1979, 1980 and 1981 spawning seasons. In both experiments with coho salmon the percentage of morpholine-imprinted fish that returned was significantly higher than that of control fish. There was no significant difference between returns of im-printed and control chinook salmon. We expect additional 1979 brood year chinook salmon and 1978 brood year coho salmon to return to the hatchery during the 1982 and 1983 spawning runs.

84-002069 Hess, F. and J. J. Videler. FAST CONTINUOUS SWIMMING OF SAITHE (*POLLACHIUS VIRENS*): A DYNAMIC ANALYSIS OF BENDING MOMENTS AND MUSCLE POWER. *J. Exp. Biol.* 109:229-251. Mar. 1984. SFA 29(3)
[Dep. Zool., State Univ. Groningen, P.O. Box 14, 9750 AA Haren, Netherlands]

84-002070 Holbrook, S. J. and R. J. Schmitt. EXPERIMENTAL ANALYSES OF PATCH SELECTION BY FORAGING BLACK SURFPERCH (*EMBIOTOCA JACKSONI* AGAZZI). *J. Exp. Mar. Biol. Ecol.* 79(1):39-64. 5 July 1984. SFA 29(3)
[Dep. Biol. Sci., Univ. Calif., Santa Barbara 93106]

84-002071 Ihnat, J. M and R. V. Bulkley. INFLUENCE OF ACCLIMATION TEMPERATURE AND SEASON ON ACUTE TEMPERATURE PREFERENCE OF ADULT MOUNTAIN WHITEFISH, *PROSOPIUM WILLIAMSONI*. *Environ. Biol. Fishes* 11(1):29-40. 15 June 1984. SFA 29(3)
[Utah Coop. Fish. Res. Unit, Utah State Univ., Logan 84322]

84-002072 Ilg, R. J. and D. E. Wohlschlag. INFLUENCE OF SIZE AND SCHOOLING ON FISH METABOLIC RATES. *Bull. Ecol. Soc. Am.* 62(2):85. June 1981. Abstract only. SFA 29(3)

BEHAVIOR (CONTINUED)

84-002072 CONTINUED
[McNeese State Univ., Lake Charles, LA] The maximum sustained swimming speeds of red drum *(Sciaenops ocellata)* and spotted sea trout *(Cynoscion nebulosus)* were measured over wide standard length (L, cm) ranges. Expressing speed in $L^{0.5}s^{-1}$ should standardize speed but does not. Speed remains a complex function of size, which may be expressed as $(L^{0.5}s^{-1}) = a+b(L)^{-1}$. The maximum sustained swimming speed and active metabolic rate of individual red drum were compared to the speed and metabolism of small schools of red drum at 15°C and 20 ppt salinity. Schooling red drum were able to swim approximately 25% faster than individual fish, with a concomitant energy expenditure that was about 25% less than that of individual fish.

84-002073 Ingersoll, C. G. and D. L. Claussen. TEMPERATURE SELECTION AND CRITICAL THERMAL MAXIMA OF THE FANTAIL DARTER, *ETHEOSTOMA FLABELLARE*, AND JOHNNY DARTER, *E. NIGRUM*, RELATED TO HABITAT AND SEASON. *Environ. Biol. Fishes* 11(2):131-138. 24 Aug. 1984. SFA 29(3)
[Dep. Zool. Physiol., Univ. Wyo., Laramie 82071] Riffle dwelling fantail darters (*Etheostoma flabellare*) selected lower temperatures in winter (19.3°C) compared to pool dwelling johnny darters (*E. nigrum* 22.0°C). A similar trend was evident in summer tests (fantail darters, 20.3°C; johnny darters, 22.9°C). Summer tested animals selected higher temperatures than winter tested animals maintained at the same acclimation temperature and photoperiod. When tested together in the same gradient, both species appeared not to thermoregulate, but tended to avoid each other. Critical thermal maxima (CTMax) did not differ between seasons for either species (fantail darters, 31.1°C winter, 31.3°C summer; johnny darters, 30.9°C winter, 30.5°C summer). Differences in the thermal responses of these darters correlated with differences in their respective habitats.

84-002074 Jones, R. N.; D. J. Orth and O. E. Maughan. ABUNDANCE AND PREFERRED HABITAT OF THE LEOPARD DARTER, *PERCINA PANTHERINA*, IN GLOVER CREEK, OKLAHOMA. *Copeia* 1984(2):378-384. 1 May 1984. SFA 29(3)
[Dep. Fish. Resour. Manage., Nez Perce Tribe Idaho, Lapivai, ID 83540]

84-002075 Ketele, A. and R. Verheyen. AGGRESSION AS A FACTOR INFLUENCING THE COMPETITIVE RELATIONSHIP BETWEEN THE 3-SPINED AND THE 9-SPINED STICKLEBACK. *Aggressive Behav.* 10(2):159-160. 1984. Abstract only. SFA 29(3)
[Dep. Biol., Univ. Antwerp, Universiteitsplein 1C/2610 Wilrijk, Belgium]

84-002076 Malyukina, G. A.; E. A. Marusov and A. K. Karpov. CHEMICAL COMMUNICATION IN WHITE SEA COASTAL COD, *GADUS MORHUA MARISALBI* (GADIDAE). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 23(5):122-127. 1983. SFA 29(3)
[Biol. Fac., Moscow State Univ., Moscow, USSR]

84-002077 Moss, R. E. MICROHABITAT SELECTION IN NEOSHO RIVER RIFFLES. *Ph.D. dissertation, Univ. Kans.* 311p. 1983. From Diss. Abstr. Int. B Sci. Eng. 44(11):3292. May 1984. SFA 29(3)

84-002078 Neave, D. A. THE DEVELOPMENT OF THE RETINOMOTOR REACTIONS IN LARVAL PLAICE (*PLEURONECTES PLATESSA*, L.) AND TURBOT (*SCOPHTHALMUS MAXIMUS*, L.). *J. Exp. Mar. Biol. Ecol.* 76(2):167-175. 10 Apr. 1984. SFA

BEHAVIOR (CONTINUED)

84-002078 CONTINUED 29(3)
[Scott. Mar. Biol. Assoc., Dunstaffnage Mar. Res. Lab., P.O. Box 3, Oban, Argyll PA34 4AD, Scotland]

84-002079 Power, M. E. DEPTH DISTRIBUTIONS OF ARMORED CATFISH: PREDATOR-INDUCED RESOURCE AVOIDANCE. *Ecology* 65(2):523-528. Apr. 1984. SFA 29(3)
[Div. Environ. Stud., Univ. Calif., Davis 95616]

84-002080 Quinn, T. P. and C. Groot. THE EFFECT OF WATER FLOW RATE ON BIMODAL ORIENTATION OF JUVENILE CHUM SALMON, *ONCORHYNCHUS KETA*. *Anim. Behav.* 32(2):628-629. May 1984. SFA 29(3)
[Dep. Fish. Oceans, Fish. Res. Br., Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada]

84-002081 Ribowski, A. PRIOR EXPERIENCE OF SOCIAL STATUS AFFECTING MIRROR AGGRESSION IN THE MALE SWORDTAIL. *Aggressive Behav.* 10(2):169. 1984. Abstract only. SFA 29(3)
[Zool. Inst., Univ. Hamburg, West Germany]

84-002082 Rimmer, D. M.; U. Paim and R. L. Saunders. CHANGES IN THE SELECTION OF MICROHABITAT BY JUVENILE ATLANTIC SALMON (*SALMO SALAR*) AT THE SUMMER-AUTUMN TRANSITION IN A SMALL RIVER. *Can. J. Fish. Aquatic Sci.* 41(3):469-475. Mar. 1984. In English with French summ. SFA 29(3)
[Fish. Br., Dep. Energy Nat. Resour., Main Floor, 9945 108th St., Edmonton, AB T5K 2G6, Canada]

84-002083 Romero, A. BEHAVIOR IN AN 'INTERMEDIATE' POPULATION OF THE SUBTERRANEAN-DWELLING CHARACID *ASTYANAX FASCIATUS*. *Environ. Biol. Fishes* 10(3):203-207. 15 Apr. 1984. SFA 29(3)
[Dep. Biol., Univ. Miami, P.O. Box 249118, Coral Gables, FL 33124]

84-002084 Rylander, M. K. and F. Köster. OBSERVATIONS ON THE BIOLOGY OF THE REDLIP BLENNY, *OPHIOBLENNIUS ATLANTICUS* (PISCES: BLENNIIDAE) ON THE COLOMBIAN COAST OF THE CARIBBEAN. *An. Inst. Invest. Mar. Punta de Betin* 12:105-115. 1982. In English with Spanish summ. SFA 29(3)
[Dep. Biol. Sci., Tex. Tech Univ., Lubbock 79409]

84-002085 Shparkovskiy, I. A.; I. D. Pavlov and A. D. Chinarina. BEHAVIOR OF YOUNG HATCHERY-REARED ATLANTIC *SALMO SALAR*, (SALMONIDAE) INFLUENCED BY AMINO ACIDS. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 23(4):140-147. 1983. SFA 29(3)
[Murmansk Inst. Mar. Biol., Kola Br., USSR]

84-002086 Southall, P. D. and W. A. Hubert. HABITAT USE BY ADULT PADDLEFISH IN THE UPPER MISSISSIPPI RIVER. *Trans. Am. Fish. Soc.* 113(2):125-131. Mar. 1984. SFA 29(3)
[Fla. Game Fresh Water Fish. Comm., Lake City, FL 32055]

BEHAVIOR (CONTINUED)

84-002087 Stauffer, J. R., Jr.; E. L. Melisky and C. H. Hocutt. INTERRELATIONSHIPS AMONG PREFERRED, AVOIDED, AND LETHAL TEMPERATURES OF THREE FISH SPECIES. *Arch. Hydrobiol.* 100(2):159-169. 1984. SFA 29(3)

[Appalachian Environ. Lab., Univ. Md., Cent. Environ. Estuarine Stud., Frostburg, MD 21532] Temperature preference, avoidance and lethal experiments were conducted on *Salmo gairdneri*, *Notropis hudsonius* and *Pimephales notatus*. Acclimation temperature did not influence the preference responses of *S. gairdneri*, but did affect the selected temperatures of the two cyprinids. All three species had avoidance temperatures which were within their thermal zone of tolerance at low acclimation temperatures. At the high acclimation temperature, the avoidance temperature was above the ultimate incipient lethal temperature.

84-002088 Subramanian, A. BURROWING BEHAVIOR AND ECOLOGY OF THE CRAB-EATING INDIAN SNAKE EEL *PISOODONOPHIS BORO*. *Environ. Biol. Fishes* 10(3):195-202. 15 Apr. 1984. SFA 29(3)

[Annamalai Univ., Cent. Adv. Stud. Mar. Biol., Parangipettai 608 502, Tamil Nadu, India]

84-002089 Takemura, A. ACOUSTICAL BEHAVIOR OF THE FRESHWATER GOBY *ODONTOBUTIS OBSCURA*. *Bull. Jpn. Soc. Sci. Fish.* 50(4):561-564. Apr. 1984. SFA 29(3)

[Fac. Fish., Nagasaki Univ., 1-14, Bunkyo, Nagasaki 852, Japan] The calls of the fresh water goby *Odontobutis obscura* consisted of a train of about eight pulse sounds, with each lasting for about 9 msec and followed by a silent period of 30-40 msec. Each pulse sound was made of a frequency com-ponent of less than 1 kHz. They emitted vigorous calls during the repro-ductive season, May to July, while the calls were seldom heard in other seasons. No remarkable diurnal variation in the frequency of sound emitting was observed. The calls which are mainly used for threatening invaders, are made by the rubbing of the upper and lower pharyngeal teeth, and amplified by the swim-bladder. The power and the frequency range of a call are limited by the size of swim-bladder, namely the fish size.

84-002090 Tsuda, R. [ANALYSES IN SWIMMING SPEED OF BIWA SALMON.] *Mem. Fac. Agric. Kinki Univ.* No. 17. p. 151-158. Mar. 1984. In Japanese with English summ. SFA 29(3)

[Lab. Mar. Technol., Dep. Fish., Kinki Univ., Higashiosaka, Osaka 577, Japan]

84-002091 Tsukamoto, K. and T. Kajihara. ON THE RELATION BETWEEN YOLK ABSORPTION AND SWIMMING ACTIVITY IN THE AYU LARVAE *PLECOGLOSSUS ALTIVELIS*. *Bull. Jpn. Soc. Sci. Fish.* 50(1):59-61. Jan. 1984. SFA 29(3)

[Ocean Res. Inst., Univ. Tokyo, Nakano-ku, Tokyo 164, Japan]

84-002092 Tyus, H. M.; B. D. Burdick and C. W. McAda. USE OF RADIOTELEMETRY FOR OBATINING HABITAT PREFERENCE DATA ON COLORADO SQUAWFISH. *N. Am. J. Fish. Manage.* 4(2):117-180. 1984. SFA 29(3)

[U.S. FWS, 447 East Main St., Vernal, UT 84078] Habitat preference of Colorado squawfish *Ptychocheilus lucius* were obatined from 2,329 observations of 22 radiotelemetered fish and compared with habitat

BEHAVIOR (CONTINUED)

84-002092 CONTINUED information obtained at the point of capture for 241 fish. Depth, velocity, and substrate preferences also were compared by these two methods. Radiotelemetry observations appear to avoid some of the bias from conventional collections, and can provide a better understanding of habitat requirements for stream fishes.

84-002093 Vandelannoote, A. and R. F. Verheyen. CIRCADIAN RHYTHMS IN AGGRESSION OF NINE- AND THREE-SPINED STICKLEBACKS. *Aggressive Behav.* 10(2):174. 1984. Abstract only. SFA 29(3)
[Dep. Biol., Univ. Antwerp, Universiteitsplein 1/2610 Wilrijk, Belgium]

84-002094 Videler, J. J. and F. Hess. FAST CONTINUOUS SWIMMING OF TWO PELAGIC PREDATORS, SAITHE (*POLLACHIUS VIRENS*) AND MACKEREL (*SCOMBER SCOMBRUS*): A KINEMATIC ANALYSIS. *J. Exp. Biol.* 109:209-228. Mar. 1984. SFA 29(3)
[Dep. Zool., State Univ. Groningen, P.O. Box 14, 9750 AA Haren, Netherlands]

84-002095 Webb, P. W. BODY FORM, LOCOMOTION AND FORAGING IN AQUATIC VERTEBRATES. *Am. Zool.* 24(1):107-120. 1984. SFA 29(3)
[Sch. Nat. Resour., Univ. Mich., Ann Arbor 48109]

84-002096 Webb, P. W.; P. T. Kostecki and E. D. Stevens. THE EFFECT OF SIZE AND SWIMMING SPEED ON LOCOMOTOR KINEMATICS OF RAINBOW TROUT. *J. Exp. Biol.* 109:77-95. Mar. 1984. SFA 29(3)
[Sch. Nat. Resour., Univ. Mich., Ann Arbor 48109]

84-002097 Wheeler, J. P. and G. H. Winters. HOMING OF ATLANTIC HERRING (*CLUPEA HARENGUS HARENGUS*) IN NEWFOUNDLAND WATERS AS INDICATED BY TAGGING DATA. *Can. J. Fish. Aquatic Sci.* 41(1):108-117. Jan. 1984. In English with French summ. SFA 29(3)
[Dep. Fish. Oceans, P.O. Box 5667, St. John's, NF A1C 5X1, Canada]

84-002098 Yamagishi, H.; K. Takano and H. Ohta. SOCIAL BEHAVIOUR OF THE WHITE-EDGED ROCKFISH, *SEBASTES TACZANOWSKII* (STEINDACHNER). *Bull. Fac. Fish. Hokkaido Univ.* 35(1):1-7. Mar. 1984. In Japanese with English summ. SFA 29(3)
[Dep. Zool., Fac. Med., Teikyou Univ., Japan]

84-002099 Zimmerman, L. C.; E. A. Standora; J. R. Spotila and T. A. Tuel. A BIOTELEMETRIC FIELD EXPERIMENT TO TEST REACTIVE AND PREDICTIVE THERMOREGULATION IN LARGEMOUTH BASS *(MICROPTERUS SALMOIDES). Bull. Ecol. Soc. Am.* 63(2):139. June 1982. Abstract only. SFA 29(3)
[Dep. Biol., State Univ. Coll., Buffalo, NY]

LIFE HISTORY-GENERAL WORKS

84-002100 Adamicka, P. DER AYU *(PLECOGLOSSUS ALTIVELIS* T. ET S.), EIN INTERESSANTER VERTRETER DER JAPANISCHEN FISCHFAUNA. [THE AYU *(PLECOGLOSSUS ALTIVELIS* P. AND S.), AN INTERESTING MEMBER OF THE JAPANESE FISH FAUNA.]

LIFE HISTORY-GENERAL WORKS (CONTINUED)

84-002100 CONTINUED *Osterreichs Fisch.* 37(5-6):140-147. May-June 1984. In German with English summ. SFA 29(3)
[Biol. Stn. Lunz, West Germany]

84-002101 Babiker, M. M. ASPECTS OF THE BIOLOGY OF THE CATFISH *CLARIAS LAZERA* (CUV. & VAL.) RELATED TO ITS ECONOMIC CULTIVATION. *Hydrobiologia* 110:295-304. 23 Mar. 1984. SFA 29(3)
[Hydrobiol. Res. Unit, Fac. Sci., Univ. Khartoum, Sudan]

84-002102 Baltz, D. M. LIFE HISTORY VARIATION AMONG FEMALE SURFPERCHES (PERCIFORMES: EMBIOTOCIDAE). *Environ. Biol. Fishes* 10(3):159-171. SFA 29(3)
[Dep. Wildl. Fish. Biol., Univ. Calif., Davis 95616]

84-002103 Brill, J. *PROFUNDULUS PUNCTATUS* (GUENTHER), A RARELY SEEN NEW WORLD KILLIFISH. *Trop. Fish Hobbyist* 32(10):59-63. June 1984. SFA 29(3)

84-002104 Chavance, P.; C. Flores-Coto and A. Sanchez-Iturbe. EARLY LIFE HISTORY AND ADULT BIOMASS OF SEA BREAM IN THE TERMINOS LAGOON, SOUTHERN GULF OF MEXICO. *Trans. Am. Fish. Soc.* 113(2):166-177. Mar. 1984. SFA 29(3)
[Cent. Oceanol. Marseille, Stn. Mar. d'Endoume, Rue de la Batterie des Lions, 13007 Marseille, France]

84-002105 Daniels, R. A. COEXISTENCE IN THREE SPECIES OF STREAM SCULPINS. *Bull. Ecol. Soc. Am.* 63(2):113. June 1982. Abstract only. SFA 29(3)
[N.Y. State Mus., Biol. Surv., Albany]

84-002106 Dick, M. H. and I. M. Warner. PACIFIC SAND LANCE, *AMMODYTES HEXAPTERUS* PALLAS, IN THE KODIAK ISLAND GROUP, ALASKA. *Syesis* 15:43-50. 1982. SFA 29(3)
[Dep. Biol., West. Wash. Univ., Bellingham 98225]

84-002107 Guier, C. R.; L. E. Nichols and R. T. Rachels. BIOLOGICAL INVESTIGATION OF FLATHEAD CATFISH IN THE CAPE FEAR RIVER. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 35:607-621. 1981. SFA 29(3)
[N.C. Wildl. Resour. Div., Raleigh 27611]

84-002108 Guma'a, S. A. and M. Yassin. THE FOOD AND GROWTH OF PELAGIC 0+ *ALESTES NURSE* (CHARACIDAE) FROM THE BLUE NILE, NEAR KHARTOUM. *Hydrobiologia* 110:273-279. 23 Mar. 1984. SFA 29(3)
[Dep. Zool., Fac. Sci., Univ. Khartoum, Sudan]

84-002109 Haynes, C. M.; T. A. Lytle; E. J. Wick and R. T. Muth. LARVAL COLORADO SQUAWFISH (*PTYCHOCHIELUS LUCIUS* GIRARD) IN THE UPPER COLORADO RIVER BASIN, COLORADO 1979-1981. *Southwest. Nat.* 29(1):21-33. 23 Mar. 1984. SFA 29(4)
[Nongame Res. Unit, Colo. Div. Wildl., 317 W. Prospect, Ft. Collins 80526] A survey of the Colorado River drainage in Colorado was made during the summer-fall of 1979-1981 to determine the distribution of larval Colorado squawfish (*Ptychochielus lucius*) and to relate their occurrence to the hydrological regime. Squawfish larvae were collected in the lowermost 31 km

LIFE HISTORY-GENERAL WORKS (CONTINUED)

84-002109 CONTINUED of the mainstem Colorado River in 1979-1981 and the lowermost 29 km of the Yampa River in 1980-1981. Larval squawfish were not found in collections from either the White or Gunnison rivers. Sampling effort appeared to have no effect on collection success, but collection success did appear to reflect reproductive success and/or larval survivorship. Estimates of spawning periods of the Colorado River range from as early as 18 June in 1981 to as late as 26 August in 1980. In the Yampa, we estimate that spawning as early as 16 June in 1980 and as late as 3 August in 1981. Our observations and spawning period estimates support the hypothesis that reproductive success is related to both the flow and temperature regimes; however, other exogenous (e.g. photoperiod, water quality, etc.) and biotic factors (e.g. competition, predation) have yet to be adequately investigated.

84-002110 Holt, C. S. and P. A. Durkee. THE DISTRIBUTION, ECOLOGY AND GROWTH OF THE CHESTNUT LAMPREY, *ICHTHYOMYZON CASTANEUS*, IN THE CLEARWATER RIVER, MINNESOTA. *J. Minn. Acad. Sci.* 49(2):35-38. 1983/84. SFA 29(3)

[Dep. Biol., Bemidji State Univ., Bemidji, MN] This study dealt primarily with the ammocoete stage of the chestnut lamprey, *Ichthymyzon castaneus* (Girard). The population estimate for ammocoetes in the 25.5 m^2 section studied was 540 individuals. The lengths of 542 ammocoetes collected ranged from 42 to 164 mm. A total of 213 chestnut lampreys were retained for laboratory study. Twenty of these were adults with an average length of 136.8 mm (range = 125 mm to 191 mm). Six age classes of ammocoetes were determined. An average increase in body length of recaptured ammocoetes of 2.9 mm was observed during the summers of 1980 and 1981. The habitat preference of the chestnut lamprey was sand-silt substrate in the littoral zone, with a dense cover of Canadian waterweed, *Elodea canadensis*, in water depths of 10 cm to 45 cm. No signs of scarring or lamprey attachment were observed on 175 fish in the study area; it is suggested that lampreys moved downstream to areas of higher densities of host fish.

84-002111 Iitaka, Y.; T. Morinaga and K. Uchihashi. [ON THE SEA RUN AMAGO SALMON IN USHIMADO WATERS.] *Mem. Fac. Agric. Kinki Univ.* No. 17. p. 143-150. Mar. 1984. In Japanese with English summ. SFA 29(3)

[Lab. Fish. Gear, Dep. Fish., Kinki Univ., Higashiosaka, Osaka 577, Japan]

84-002112 Kilambi, R. V. and A. Zdinak. THE BIOLOGY OF STRIPED BASS, *MORONE SAXATILIS*, IN BEAVER RESERVOIR, ARKANSAS. *Proc. Ark. Acad. Sci.* 35:43-45. 1981. SFA 29(3)

[Dep. Zool., Univ. Ark., Fayetteville 72701] Growth, length-weight relationship, maturation and food habits of striped bass from Beaver reservoir were studied. No significant difference in growth in length between sexes was found. Growth of the Beaver Reservoir striped bass was similar to that of anadromous and freshwater populations. Males and females showed significant difference in length-weight relationship, and females exhibited isometric growth. The gonosomatic indices (GSI) of males ranged from 4.50 to 7.09 and were classified as mature fish. Female striped bass with GSI of 2.62 and above had three size groups of ova and were considered as maturing and mature. The food was primarily composed of gizzard shad. Both the possible impact of striped bass on the ecosystem of Beaver Reservoir and future research are discussed.

84-002113 Kolotin, Y. M. MORPHOECOLOGICAL PECULIARITIES OF THE BREAM, *ABRAMIS BRAMA ORIENTALIS* (CYPRINIDAE), FROM LAKE BALKHASH. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 23(4):46-55. 1983. SFA 29(3)

[KazNIIRKh, Petropavlovsk, Kazakh, USSR]

LIFE HISTORY-GENERAL WORKS (CONTINUED)

84-002114 Matthews, M. M. and D. C. Heins. LIFE HISTORY OF THE REDFIN SHINER, *NOTROPIS UMBRATILIS* (PISCES: CYPRINIDAE), IN MISSISSIPPI. *Copeia* 1984(2):385-390. 1 May 1984. SFA 29(3)
[Dep. Microsc. Anat., Baylor Coll. Dent., Dallas, TX 75246] *Notropis umbratilis* from Tallahalla Creek, Hinds County, Mississippi, was studied from May 1979 through May 1980. The study area and species associates are considered briefly. Data from 1979 and 1980 demonstrated a reproductive season extending from late April or early May into late Aug. All females 32 mm SL or larger were sexually mature. Counts of mature ova were correlated with female size and ranged from 219 to 887 for females 34-52 mm SL. Average size of unovulated mature ova in individual females ranged from 0.72-0.87 mm diameter with a grand mean of 0.81 mm. Most *N. umbratilis* live somewhat less than 1½ years with some individuals living to about 2 years. Maturity occurs at about 1 year. Maximum size was 59 mm SL.

84-002115 Milton, D. A. and A. H. Arthington. REPRODUCTIVE STRATEGY AND GROWTH OF THE CRIMSON-SPOTTED RAINBOWFISH, *MELANOTAENIA SPLENDIDA FLUVIATILIS* (CASTELNAU) (PISCES: MELANOTAENIIDAE) IN SOUTH-EASTERN QUEENSLAND. *Aust. J. Mar. Freshwater Res.* 35(1):75-83. 1984. SFA 29(3)
[Sch. Aust. Environ. Stud., Griffith Univ., Nathan, Queensland 4111, Australia]

84-002116 Minami, T. [THE EARLY LIFE HISTORY OF A FLOUNDER *KAREIUS BICOLORATUS.*] *Bull. Jpn. Soc. Sci. Fish.* 50(4):551-560. Apr. 1984. In Japanese with English summ. SFA 29(3)
[Japan Sea Reg. Fish. Res. Lab., Niigata 951, Japan]

84-002117 Myllylä, M.; M. Torssonen; E. Pulliainen and K. Kuusela. BIOLOGICAL STUDIES ON THE MINNOW, *PHOXINUS PHOXINUS*, IN NORTHERN FINLAND. *Aquilo* 22:149-156. 1983. SFA 29(3)
[Dep. Zool., Univ. Oulu, Oulu, Finland]

84-002118 Pasch, R. W.; P. A. Hackney and J. A. Holbrook II. ECOLOGY OF THE PADDLEFISH, *POLYODON SPATHULA* (WALBAUM), IN OLD HICKORY RESERVOIR, TENNESSEE, WITH EMPHASIS ON FIRST-YEAR LIFE HISTORY AND THE EFFECTS OF IMPINGEMENT AT GALLATIN STEAM PLANT ON THE POPULATION. *Tenn. Valley Auth. (Norris)* NP-1903797. 55p. Jan. 1978. From U.S. Gov. Rep. 84(10):111. 11 May 1984. Available from NTIS as DE 81903797. Microfiche copies only. SFA 29(3)

84-002119 Rogers, S. G. and M. J. Van Den Avyle. SPECIES PROFILE: LIFE HISTORIES AND ENVIRONMENTAL REQUIREMENTS OF COASTAL FISHES AND INVERTEBRATES (SOUTH ATLANTIC). *U.S. Fish and Wildl. Serv.* FWS/OBS-82/11.15. vii + 14p. Oct. 1983. SFA 29(3)
[Ga. Coop. Fish. Res. Unit, Sch. For. Resour., Univ. Ga., Athens 30602]

84-002120 Ruple, D. L.; R. H. McMichael, Jr. and J. A. Baker. LIFE HISTORY OF THE GULF DARTER, *ETHEOSTOMA SWAINI* (PISCES: PERCIDAE). *Environ. Biol. Fishes* 11(2):121-130. 24 Aug. 1984. SFA 29(3)
[Gulf Coast Res. Lab., East Beach Dr., Ocean Springs, MS 39564] *Etheostoma swaini*, the gulf darter, was collected from the Black Creek drainage in southern Mississippi (February 1978-April 1979). The gulf darter generally inhabits small- to moderate-size creeks and occurs over a sand or sandy mud bottom, often in association with aquatic vegetation or a layer of organic debris. Larval dipterans were the most important food

LIFE HISTORY-GENERAL WORKS (CONTINUED)

84-002120 CONTINUED items, both numerically and volumetrically. Chironomids were found in 71-100% of the stomachs in all except the unusual March 16 collection. The length frequency distribution and the scale annuli analysis indicated there were three year-classes present in the population at any one time. Fifty-one percent of the specimens taken were less than 12 months old. During the mid-February to late March spawning season gulf darters were most often collected over clean gravel or gravelsand substrates. Laboratory observations suggest that the female burrows into the gravel where the demersal, adhesive eggs are deposited. Female gulf darters significantly outnumbered males at a ratio of 59:41.

84-002121 Sainsbury, K. J. and A. W. Whitelaw. BIOLOGY OF PERON'S THREADFIN BREAM, *NEMIPTERUS PERONII* (VALENCIENNES), FROM THE NORTH WEST SHELF OF AUSTRALIA. *Aust. J. Mar. Freshwater Res.* 35(2):167-185. 1984. SFA 29(3)
[Div. Fish. Res., CSIRO Mar. Lab., P.O. Box 21, Cronulla, N.S.W. 2230, Australia]

84-002122 Seaman, W., Jr. and M. Collins. SPECIES PROFILES: LIFE HISTORIES AND ENVIRONMENTAL REQUIREMENTS OF COASTAL FISHES AND INVERTEBRATES (SOUTH FLORIDA). *U.S. Fish Wildl. Serv.* FWS/OBS-82/11.16. vi + 16p. Oct. 1983. SFA 29(3)
[Sea Grant, Univ. Fla., Gainesville 32611]

84-002123 Shireman, J. V. and C. R. Smith. SYNOPSIS OF BIOLOGICAL DATA ON THE GRASS CARP, *CTENOPHARYNGODON IDELLA* (CUVIER AND VALENCIENNES, 1844). *FAO Fish. Synop.* No. 135. iv + 86p. 1983. SFA 29(3)
[Cent. Aquatic Weeds, Univ. Fla, Gainesville 32601]

84-002124 Troitskiy, S. K. and Y. P. Tsunikova. BIOLOGY OF THE "MONKEY GOBY", *NEOGOBIUS FLUVIATILIS* (GOBIIDAE), IN THE KUBAN LAGOONS. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 23(4):39-45. 1983. SFA 29(3)
[AzNIIRKh, Rostov-on-Don, USSR]

84-002125 Wenner, C. A. NOTES ON THE OPHIDIOID FISH *DICROLENE INTRONIGRA* FROM THE MIDDLE ATLANTIC CONTINENTAL SLOPE OF THE UNITED STATES. *Copeia* 1984(2):538-541. 1 May 1984. SFA 29(3)
[S.C. Mar. Resour. Res. Inst., P.O. Box 12559, Charleston 29412]

84-002126 Yano, K. and S. Tanaka. SOME BIOLOGICAL ASPECTS OF THE DEEP SEA SQUALOID SHARK *CENTROSCYMNUS* FROM SURUGA BAY, JAPAN. *Bull. Jpn. Soc. Sci. Fish.* 50(2):249-256. Feb. 1984. SFA 29(3)
[Dep. Fish., Fac. Mar. Sci. Technol., Tokai Univ., Shimizu 424, Japan] Specimens of the deep sea sharks, *Centroscymnus coelolepis* and *C. owstoni*, were caught with bottom drop line, bottom longline, and bottom gillnet in Suruga Bay, Japan. The catch rates of males were higher than catch rates of females on the bottom drop lines. In both species, the females were distributed in deeper layers than the males, but the distribution of *C. owstoni* seemed to extend to shallower layers than that of *C. coelolepis*. The smaller individuals of both species, those below 600 mm in total length (T.L.), were thought to inhabit separate areas such as the waters outside of the bay. The stomach contents of both species consisted mainly of fish and squid. Empty stomachs were more frequently found during the daytime than at night. The proportion of the weight of

LIFE HISTORY-GENERAL WORKS (CONTINUED)

84-002126 CONTINUED the intestinal contents to the weight of the intestine was found to be higher during the night than during the day.

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC.

84-002127 Alevizon, W. and D. Landmeier. VARIABILITY IN THE POPULATION STRUCTURES OF FOUR WESTERN ATLANTIC PARROTFISHES. *Environ. Biol. Fishes* 10(3):149-158. 15 Apr. 1984. SFA 29(3)
[Dep. Biol. Sci., Fla. Inst. Technol., Melbourne, FL 32901]

84-002128 Aro, E. and B. Sjöblom. THE ABUNDANCE OF BALTIC HERRING AND SPRAT ACCORDING TO ECHO COUNTING IN THE SEAS AROUND FINLAND IN 1982. *Int. Counc. Explor. Sea* C.M. 1983/J:22. 13p. 1983. In English with French summ. SFA 29(3)
[Finn. Game Fish. Res. Inst., Fish. Div., P.O. Box 193, SF-00131 Helsinki 13, Finland]

84-002129 Aro, E. and V. Sjöblom. COD OFF THE COAST OF FINLAND IN 1974-82. *Int. Counc. Explor. Sea* C.M. 1983/J:25. 17p. 1983. In English with French summ. SFA 29(3)
[Finn. Game Fish Res. Inst., Fish. Div., P.O. Box 193, SF-00131 Helsinki 13, Finland]

84-002130 Aro, E.; V. Sjöblom and R. Hudd. THE ABUNDANCE OF O-GROUP BALTIC HERRING OFF THE COAST OF FINLAND IN 1979-82. *Int. Counc. Explor. Sea* C.M. 1983/J:23. 9p. 1983. In English with Frensh summ. SFA 29(3)
[Finn. Game Fish. Res. Inst., Fish. Div., P.O. Box 193, SF-00131 Helsinki 13, Finland]

84-002131 Auer, N. A. and M. T. Auer. WALLEYE (*STIZOSTEDION VITERUM*) EGG HATCHING SUCCESS IN THE LOWER FOX RIVER (WISCONSIN). *Prog. Conf. Great Lakes Res.* 27:26. 1984. Abstract only. SFA 29(3)
[Dep. Biol. Sci., Mich. Technol. Univ., Houghton 49931]

84-002132 Avery, E. L. POPULATION DYNAMICS OF WILD TROUT AND ASSOCIATED SPORT FISHERIES IN TWO NORTHERN WISCONSIN STREAMS. *Wis. Dep. Nat. Resour. Tech. Bull.* No. 141. 31p. 1983. SFA 29(3)
[Wis. Dep. Nat. Resour., Rt. 1, Box 589, Waupaca 54981] Angler harvest in central Wisconsin trout streams has substantially reduced normal densities of wild brown trout (*Salmo trutta*) greater than 10 inches, especially age III + fish. Consequently, recruitment is largely dependent upon only one or two of the younger age groups of spawners. The present study, conducted from April 1979 through April 1981, was undertaken to determine what effect angler harvest is having on wild trout populations in northern Wisconsin streams. The study describes the structure and dynamics of wild brown trout and brook trout (*Salvelinus fontinalis*) populations in two northern Wisconsin streams, characterizes the associated sport fisheries, and discusses the managerial significance of angler harvest on these populations. Spring and fall population densities of brown trout in Beaver Creek were lower than in

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC. (CONTINUED)

84-002132 CONTINUED nine other Class I brown trout streams in Wisconsin. Brown trout densities in Eighteen Mile Creek were among the highest observed, however. Spring standing stocks in both study streams were generally below the standing stocks in other Class I trout streams, but in the fall standing stocks compared favorably with northern Wisconsin trout streams. The seasonal movement of larger, older brown trout in northern Wisconsin streams was of much greater magnitude and of much greater importance as a management factor compared to brown trout studied in central Wisconsin streams. No major revisions of harvest regulations are needed in the immediate future to protect wild brown trout populations in northern Wisconsin. The greater vulnerability of brook trout to angler harvest, even at the low fishing pressures observed, emphasizes a need for a more intensive study of wild brook trout and their sport fisheries in northern Wisconsin.--from abstr.

84-002133 Babiker, M. M. SEASONAL ABUNDANCE, BREEDING AND SEX-STRUCTURE OF POPULATIONS OF *TILAPIA NILOTICA* (L.) AND *LABEO NILOTICUS* (F.) IN THE JEBEL AULIA DAM AREA OF THE WHITE NILE. *Hydrobiologia* 110:287-294. 23 Mar. 1984. SFA 29(3)
[Hydrobiol. Res. Unit, Fac. Sci., Univ. Khartoum, Sudan]

84-002134 Cochrane, K. L. THE INFLUENCE OF FOOD AVAILABILITY, BREEDING SEASONS AND GROWTH RATE ON COMMERCIAL CATCHES OF *LIMNOTHRISSA MIODON* (BOULENGER) IN LAKE KARIBA. *J. Fish Biol.* 24(6):623-635. June 1984. SFA 29(3)
[Natl. Inst. Water Res., P.O. Box 395, Pretoria 0001, South Africa] Commercial catches of *Limnothrissa miodon* in Lake Kariba show clear seasonal fluctuations. Recruitment to the pelagic fishing areas was investi-gated. A von Bertalanffy growth curve for the species was calculated and the breeding season determined from the calculated hatching dates of observed alevins and juveniles. Distribution of the different size classes was determined by a horizontal transect. Analysis of body composition showed a decrease in total lipids at the time when catches were dropping. This was shown to be due to a decline in triglyceride fat reserves apparently re-sulting from food stress and possibly resulting in increased natural mortality. Recruitment to the fishing areas and the total mortality rate are believed to cause the seasonal fluctuations in catch. The annual cycle of production may be caused by the summer inflow of nutrients from the rivers. Growth is apparently stunted in comparison to the species' growth rate in Lake Tanganyika, probably due to the lower nutrient status of Lake Kariba.

84-002135 Collins, J. J. TRENDS IN THE NORTH CHANNEL FISH COMMUNITY, ESPECIALLY ITS LAKE WHITEFISH COMPONENT. *Prog. Conf. Great Lakes Res.* 27:34. 1984. Abstract only. SFA 29(3)
[Ontario Minist. Nat Resour., Lake Huron Fish. Res. Unit, R.R. #1, Tehkummah, ON POP 2CO, Canada]

84-002136 de Ciechomski, J. D.; R. P. Sánchez; C. A. Lasta and M. D. Ehrlich. DISTRIBUCION DE HUEVOS Y LARVAS DE ANCHOITA (*ENGRAULIS ANCHOITA*).Y DE MERLUZA (*MERLUCCIUS HUBBSI*), EVALUACION DE SUS EFECTIVOS DESOVANTES Y ANALISIS DE LOS METODOS EMPLEADOS. [DISTRIBUTION OF EGGS AND LARVAE OF THE ANCHOVY (*ENGRAULIS ANCHOITA*) AND THE HAKE (*MERLUCCIUS HUBBSI*), ESTIMATES OF SPAWNING BIOMASS AND ANALYSIS OF TWO METHODS APPLIED. *Inst. Nac. Invest. Desarr. Pesq. Contrib.* No. 432. p. 3-37. Dec. 1983. In Spanish with English summ. SFA 29(3)
[Inst. Nac Invest. Desarr. Pesq., Mar Del Plata, Cas. Correo 175, Argentina]

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC. (CONTINUED)

84-002137 Dewey, M. R. and T. E. Moen. POPULATION DYNAMICS OF LARGEMOUTH BASS IN DEGRAY LAKE, ARKANSAS, 1975-1979. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 35:430-437. 1981. SFA 29(3)
[U.S.FWS, Arkadelphia, AR 71923] Estimates of abundance, production, growth, survival, and mortality of largemouth bass were derived from spring electrofishing samples in the upper, middle, and lower sections of DeGray Lake from 1975 to 1979. Mean population estimates ranged from 86 to 163 bass per hectare; the populations were dominated by bass of ages I and II (73% to 96%). Population estimates of the 3 coves based on surface area were biased because there were large differences in the ratio of shoreline length to surface area. Population estimates were adjusted to correct for this bias. Production was highest in the midlake section each year. Mean production estimates, based on spring electrofishing samples, ranged from 19.1 to 30.9 kg/ha. The greatest production of tissue and highest mortality occurred during the 2nd year of life. Harvest data indicated that 29.3% of the estimated spring standing crop of largemouth bass was taken by angling in 1977, and 26.8% in 1978.

84-002138 Dewey, M. R. SEASONAL ABUNDANCE, MOVEMENT AND DIVERSITY OF FISHES IN AN OZARK STREAM. *Proc. Ark. Acad. Sci.* 35:33-39. 1981. SFA 29(3)
[U.S. FWS, P.O. Box 705, Ouachita Baptist Univ., Arkadelphia, AR 71923]

84-002139 Dewey, M. R.; T. E. Moen and H. E. Bryant. SEASONAL BIOMASS OF SELECTED CENTRARCHIDS IN DEGRAY LAKE, ARKANSAS 1977-79. *Proc. Annu. Conf. Southeast Assoc. Fish Wildl. Agencies* 35:438-442. 1981. SFA 29(3)
[U.S.FWS, Arkadelphia, AR 71923] Seasonal biomass estimates of largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), and longear sunfish (*L. megalotis*) were made during 3 growing seasons (1977-79) by cove rotenone sampling in May, June, August and September. Substantial mortality of young-of-the-year (YOY) largemouth bass during late summer suggests that this period was critical in determining year-class strength. Overwinter mortality was 88, 87, and 71% for the 1977-, 1978-and 1979-year classes, respectively. Biomass of bluegill increased from May to August and decreased in September, probably as a result of predation. Biomass of longear sunfish was lowest in June and peaked in September in 2 of the 3 growing seasons. Longear sunfish seem to feed more in littoral areas than do bluegills, and are therefore probably more susceptible than bluegills to early summer predation by largemouth bass, and less susceptible than bluegills to late summer predation.

84-002140 Gladden, J. B. and L. R. Ginzburg. VARIATION AND PERSISTENCE IN STOCHASTIC POPULATION MODELS WITH DIFFERING AGE STRUCTURES. *Bull. Ecol. Soc. Am.* 63(2):139. June 1982. Abstract only. SFA 29(3)
[Savannah River Ecol. Lab., Aiken, SC]

84-002141 Green, A. W.; G. C. Matlock and J. E. Weaver. EFFECT OF FISH SIZE ON RECOVERY OF TAGGED FISHES IN AREAS TREATED WITH ROTENONE. *Annu. Proc. Tex. Chap. Am. Fish. Soc.* 2:26-37. 1980. SFA 29(3)
[Tex. Parks Wildl. Dep., 4200 Smith School Rd., Austin, TX 78744]

84-002142 Hudd, R. and E. Aro. BY-CATCH OF O-GROUP SMELT IN ISAACS-KIDD MID-WATER TRAWL HERRING CATCH OFF THE COAST OF FINLAND IN 1980-82. *Int. Counc. Explor. Sea* C.M. 1983/J:28. 8p. 1983. In English with French summ.

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC. (CONTINUED)

84-002142 CONTINUED SFA 29(3)
[Finn. Game Fish. Res. Stn., Baasa Field Stn., Rantakatu 28, SF-65120 Vaasa 12, Finland]

84-002143 Hudd, R. ASSESSMENT OF SMELT (*OSMERUS EPERLANUS* L.) STOCK IN THE BAASA ARCHIPELAGO, GULF OF BOTHNIA. *Int. Counc. Explor. Sea* C.M. 1983/J:27. 25p. 1983. In English with French summ. SFA 29(3)
[Finn. Game Fish Res. Stn., Baasa Field Stn., Rantakatu 28, SF-65120 Vaasa 12, Finland]

84-002144 Hudd, R.; L. Urho and M. Hildén. OCCURRENCE OF BURBOT, *LOTA LOTA* L., LARVAE AT THE MOUTH OF THE KRYÖNJOKI IN QUARKEN, GULF OF BOTHNIA. *Aquilo* 22:127-130. 1983. SFA 29(3)
[Finn. Game Fish. Res. Inst., Vaasa Field Stn., Rantakatu 28, Vaasa 12, Finland]

84-002145 Jacobson, P. C. COMPUTER SIMULATION OF THE POPULATION DYNAMICS OF LAKE WHITEFISH IN NORTHERN LAKE MICHIGAN. *M.S. thesis, Mich. State Univ.* 80p. 1983. From Masters Abstr. 22(2):95. June 1984. SFA 29(3)

84-002146 Laine, A. and T. Valtonen. THE STRUCTURE AND YEILD PER RECRUIT OF VENDACE STOCKS IN SEA AREAS OUTSIDE KEMI AND OULU IN THE NORTHERN BOTHNIAN BAY. *Aquilo* 22:31-36. 1983. SFA 29(3)
[Perämeri Res. Stn., Univ. Oulu, Oulu, Finland]

84-002147 Orth, D. J.; D. D. Oakey and O. E. Maughan. POPULATION CHARACTERISTICS OF SMALLMOUTH BASS IN GLOVER CREEK, SOUTHEAST OKLAHOMA. *Proc. Okla. Acad. Sci.* 63:37-41. 1983. SFA 29(3)
[Dep. Fish. Wildl. Sci., VPI & SU, Blacksburg, VA 24061] Smallmouth bass *(Micropterus dolomieui)* were collected from Glover Creek in 1977-79 to document growth patterns, age and length structure, and relative condition. Maximum age was 6 years, although the majority of fish were less than 3 years old. Annual survival of adults (age 2 and older) was estimated as 39% with 95% confidence limits from 32 to 47%. Proportional stock density was 19%. Growth was relatively slow compared to that of other stream populations. Relative weight was less than 100 for all age groups except age 0. Seasonal patterns in growth and condition indicated that growth slowed during late summer.

84-002148 Parmanne, R. and V. Sjöblom. DIFFERENCES IN THE STATE OF HERRING STOCKS IN THE NORTHERN AND SOUTHERN PART OF THE GULF OF FINLAND. *Int. Counc. Explor. Sea* C.M. 1983/J:21. 17p. 1983. In English with French summ. SFA 29(3)
[Finn. Game Fish. Res. Inst., Fish. Div., P.O. Box 193, SF-00131 Helsinki 13, Finland]

84-002149 Portt, C. B. and E. K. Balon. A POTENTIAL SOURCE OF ERROR WHEN ESTIMATING ECOLOGICAL PRODUCTION OF FISHES USING BACK-CALCULATIONS. *Environ. Biol. Fishes* 10(4):301-303. 30 May 1984. SFA 29(3)
[Dep. Zool., Univ. Guelph, Guelph, ON NIG 2W1, Canada] Fish production estimates determined from weights back-calculated to the time of annulus formation were found to underestimate actual production by 12 to 44%. It is

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC. (CONTINUED)

84-002149 CONTINUED suggested that production should either estimated from weights at the time of collection or a correction factor should be employed when back-calculating weights.

84-002150 Robblee, M. B. and J. C. Zieman. MICROHABITAT VARIATION AND THE STRUCTURE OF THE NOCTURNAL FISH COMMUNITY IN A TROPICAL SEAGRASS BED. *Bull. Ecol. Soc. Am.* 63(2):125. June 1982. Abstract only. SFA 29(3)
[Univ. Va., Charlotteville]

84-002151 Ryan, P. M. FYKE NET CATCHES AS INDICES OF THE ABUNDANCE OF BROOK TROUT, *SALVELINUS FONTINALIS*, AND ATLANTIC SALMON, *SALMO SALAR*. *Can. J. Fish. Aquatic Sci.* 41(2):377-380. Feb. 1984. In English with French summ. SFA 29(3)
[Dep. Fish. Oceans, P.O. Box 5667, St. John's, NF A1C 5X1, Canada]

84-002152 Sale, P. F. and W. A. Douglas. TEMPORAL VARIABILITY IN THE COMMUNITY STRUCTURE OF FISH ON CORAL PATCH REEFS AND THE RELATION OF COMMUNITY STRUCTURE TO REEF STRUCTURE. *Ecology* 65(2):409-422. Apr. 1984. SFA 29(3)
[Sch. Biol. Sci., Univ. Sydney, Sydney, N.S.W. 2006, Australia]

84-002153 Sherman, K.; R. Lasker; W. Richards and A. W. Kendall, Jr. ICHTHYOPLANKTON AND FISH RECRUITMENT STUDIES IN LARGE MARINE ECOSYSTEMS. *Mar. Fish. Rev.* 45(10-12):1-25. Oct.-Dec. 1983. SFA 29(3)
[NMFS, Narragansett, RI 02882]

84-002154 Shul'man, G. E.; L. S. Oven and S. Y. Urdenko. ESTIMATION OF GENERATIVE PRODUCTION OF BLACK SEA FISH. *Dokl. Biol. Sci. (Engl. Transl. Dokl. Akad. Nauk SSSR)* 272(1-6):511-513. Sept.-Oct. 1983. SFA 29(3)
[Inst. Biol. South Seas, Acad. Sci. Ukranian SSR, Sevastopol, USSR]

84-002155 Smetanin, M. M.; A. S. Strel'nikov and V. G. Tereshchnenko. APPLYING INFORMATION THEORY TO ANALYSIS OF CATCH DYNAMICS OF FISH IN INCIPIENT ECOSYSTEMS. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 23(4):1-7. 1983. SFA 29(3)
[Inst. Biol. Inland Waters, USSR Acad. Sci., Borok, Yaroslavl Prov., USSR]

84-002156 Snetkov, M. A. and G. G. Yuzhakova. DETERMINATION OF POPULATION OF SEVAN WHITEFISH [*COREGONUS LAVARETUS* (L.)] FROM VALUE OF EXPOLITATION COEFFICIENT. *Dokl. Biol. Sci. (Engl. Transl. Dokl. Akad. Nauk SSSR)* 272(1-6):516-518. Sept.-Oct. 1983. SFA 29(3)
[A. N. Severtsov Inst. Evol. Morphol. Anim. Ecol., Acad. Sci. USSR, Moscow, USSR]

84-002157 Stollery, K. OPTIMAL VERSUS UNREGULATED INDUSTRY BEHAVIOR IN A BEVERTON-HOLT MULTICOHORT FISHERY MODEL. *Can. J. Fish. Aquatic Sci.* 41(3):446-450. Mar. 1984. In English with French summ. SFA 29(3)
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84-002158 Abd el Rahman, A. and A. I. el Moghraby. BREEDING OF *BARBUS BYNNI* (PISCES, CYPRINIDAE) IN JEBEL AULIA RESERVOIR, SUDAN. *Hydrobiologia* 110:319-325. 23 Mar. 1984. SFA 29(3)
[Fish. Hydrobiol. Res. Cent., Khartoum, Sudan]

84-002159 Able, K. W. VARIATION IN SPAWNING SITE SELECTION OF THE MUMMICHOG, *FUNDULUS HETEROCLITUS*. *Copeia* 1984(2):522-525. 1 May 1984. SFA 29(3)
[Dep. Biol. Sci., Cent. Coastal Environ. Stud., Rutgers Univ., New Brunswick, NJ 08903]

84-002160 Alekseyeva, Y. I. and F. Y. Alekseyev. SOME ASPECTS OF REPRODUCTIVE BIOLOGY OF THE LANTERNFISHES, *MYCTOPHUM PUNCTATUM* AND *NOTOSCOPELUS RESPLENDENS* (MYCTOPHIDAE), FROM THE EASTERN TROPICAL ATLANTIC. *J. Ichthyol. (Eng. Transl. Vopr. Ikhtiol.)* 23(5):56-63. 1983. SFA 29(3)
[AtlantNIRO, Kaliningrad, USSR]

84-002161 Andrianov, D. P. and L. A. Lisovenko. NEW DATA ON THE REPRODUCTION OF THE PERUVIAN HAKE, *MERLUCCIUS GAYI PERUANUS* (MERLUCCIDAE). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 23(4):62-72. 1983. SFA 29(3)
[VNIRO, Moscow, USSR]

84-002162 Azuma, H. SPAWNING OF PURPLE GUDGEON. *Trop. Fish Hobbyist* 32(10):40-41, 44-45, 48. June 1984. SFA 29(3)

84-002163 Brillet, C. ÉTUDE COMPARATIVE DE LA PARADE NUPTIALE CHEZ DEUX ESPÈCES DE POISSONS AMPHIBIES SYMPATRIQUES (*PISCES PERIOPHTALMIDAE*). [COMPARATIVE STUDY OF SEXUAL DISPLAY IN TWO SPECIES OF SYMPATRIC AMPHIBIOUS FISH (*PISCES PERIOPHTALAMIDAE*).] *C.R. Hebd. Seances Acad. Sci. Ser. III Sci. Vie* 298(12):347-350. 28 Mar. 1984. In French with English summ. SFA 29(3)
[Inst. Neurophysiol. Psychophysiol., Dep. Psychophysiol. Comp., 31, Chem. Joseph-Aiguier, 13274 Marseille Cedex 2, France]

84-002164 Chebanov, N. A.; N. V. Varnavskaya and V. S. Varnavskiy. EFFECTIVENESS OF SPAWNING OF MALE SOCKEYE SALMON, *ONCORHYNCHUS NERKA* (SALMONIDAE), OF DIFFERING HIERARCHICAL RANK BY MEANS OF GENETIC-BIOCHEMICAL MARKERS. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 23(5):51-55. 1983. SFA 29(3)
[KoTINRO, Petropavlovsk-Kamchatskiy, USSR]

84-002165 Christie, R. W.; P. T. Walker; A. G. Eversole and T. A. Curtis. DISTRIBUTION OF SPAWNING BLUEBACK HERRING ON THE WEST BRANCH OF COOPER RIVER AND THE SANTEE RIVER, SOUTH CAROLINA. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 35:632-640. 1981. SFA 29(3)
[S.C. Wildl. Mar. Resour. Dep., Bonneau 29431] The distribution of spawning blueback herring was determined on the West Branch of Cooper River

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC. (CONTINUED)

84-002165 CONTINUED and on the Santee River, South Carolina. On the West Branch of Cooper River, the main river channel and abandoned ricefields were utilized for spawning. The use of tributaries for spawning was limited. On the Santee River, the main river channel and tributaries were utilized for spawning. Ranges for selected physical and chemical water quality characteristics associated with the distribution of spawning blueback herring were determined from 9 Cooper River and 15 Santee River sampling stations during the herring run. Those ranges were: surface water temperature, 11-20 C; dissolved oxygen, 6-11 mg/l; dissolved carbon dioxide, 5-25 mg/l; pH, 6.0-7.5; and depth, 0.4-3.1 m.

84-002166 Ciechomski, J. D. and C. I. Booman. DISTRIBUCION CUANTITATIVA DE HUEVOS Y LARVAS DE ANCHOITA (*ENGRAULIS ANCHOITA*) EN LA PLATAFORMA CONTINENTAL, FRENTE A LAS COSTAS DE LA ARGENTINA Y URUGUAY EN EL CICLO ANUAL 1981/1982. [QUANTITATIVE DISTRIBUTION OF THE ANCHOVY (*ENGRAULIS ANCHOITA*) EGGS AND LARVAE IN THE SEA SHELF OFF ARGENTINA AND URUGUAY DURING THE ANNUAL CYCLE 1981-1982.] *Inst. Nac. Invest. Desarr. Pesq. Contrib.* No. 431. 14p. Nov. 1983. In Spanish with English summ. SFA 29(3)
[Inst. Nac. Invest. Desarr. Pesq., Mar Del Plata, Cas. Correo 175, Argentina]

84-002167 Curry, K. D. and A. Spacie. DIFFERENTIAL USE OF STREAM HABITAT BY SPAWNING CATOSTOMIDS. *Am. Midl. Nat.* 111(2):267-279. Apr. 1984. SFA 29(3)
[Dep. For. Nat. Resour., Purdue Univ., West Lafayette, IN 47907] Spawning patterns of suckers (Catostomidae) in Deer Creek, Indiana, revealed differential use by species and age-size groups. In spring, white suckers (*Catostomus commersoni*) dominated headwaters, while redhorse (*Moxostoma* spp.) were more abundant downstream. Shorthead redhorse (*M. macrolepidotum*) were present only in main stem Deer Creek during spawning. Spawning groups of golden redhorse (*M. erythrurum*) and black redhorse (*M. duquesnei*) near the mouth of Deer Creek were significantly older and larger than those upstream in a first-order tributary. Spawing was not observed until water temperatures stayed above or near 10 C and until water levels were 20-60 cm deep over spawning shoals. Golden redhorse, shorthead redhorse, and northern hogsucker (*Hypentelium nigricans*) spawned over medium gravel in riffles 30-60 cm deep with velocities of 0.4-0.9m/sec. White sucker spawned over medium gravel at depths of 20-25 cm where velocity ranged from 0.50-0.59 m/sec. Creek chubsucker (*Erimyzon oblongus*) selected fine gravel in areas 50-75 cm deep having much slower velocity (0.10-0.24 m/sec.).

84-002168 Cyrus, D. P. and S. J. M. Blaber. THE REPRODUCTIVE BIOLOGY OF *GERRES* IN NATAL ESTUARIES. *J. Fish Biol.* 24(5):491-504. May 1984. SFA 29(3)
[Dep. Zool., Univ. Zululand, PB X1001, Kwadlangezwa 3886, Natal, South Africa]

84-002169 Dombeck, M. P.; B. W. Menzel and P. N. Hinz. MUSKELLUNGE SPAWNING HABITAT AND REPRODUCTIVE SUCCESS. *Trans. Am. Fish. Soc.* 113(2):205-216. Mar. 1984. SFA 29(3)
[U.S. Dep Agric., For. Serv., Park Falls, WI 54552]

84-002170 Gronell, A. M. COURTSHIP, SPAWNING AND SOCIAL ORGANIZATION OF THE PIPEFISH, *CORYTHOICHTHYS INTESTINALIS* (PISCES: SYNGNATHIDAE) WITH NOTES ON TWO CONGENERIC SPECIES. *J. Comp. Ethol.* 65(1):1-24. May 1984.

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84-002170 CONTINUED SFA 29(3)
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[La. Dep. Wildl. Fish., Grand Isle 70358]

84-002172 Gustaveson, A. W.; T. D. Pettengill; J. E. Johnson and J. R. Wahl. IN-RESERVOIR SPAWNING OF STRIPED BASS LAKE POWELL, UTAH - ARIZONA. *Proc. Annu. Conf. West. Assoc. Fish Wildl. Agencies* 62:480-489. 1982. SFA 29(3)
[Utah Div. Wildl. Resour., Page, AZ 86040]

84-002173 Heins, D. C. and D. Davis. THE REPRODUCTIVE SEASON OF THE WEED SHINER, *NOTROPIS TEXANUS* (PISCES: CYPRINIDAE), IN SOUTHEASTERN MISSISSIPPI. *Southwest. Nat.* 29(1):133-135. 23 Mar. 1984. SFA 29(3)
[Dep. Biol., Millsaps Coll., Jackson, MS 39210]

84-002174 Joseph, G. L. and S. V. Job. STUDIES ON SPAWNING MIGRATION AND SPAWNING OF HILLSTREAM FISH *DISCOGNATHUS MULLYA* (SYKES). *J. Bombay Nat. Hist. Soc.* 80(1):80-85. Apr. 1983. SFA 29(3)
[Scott Christian Coll., Nagercoil-629 003, Kanyakumari Dist., India]

84-002175 Kirtley, P. SPAWNING *BETTA FASCIATA*. *Trop. Fish Hobbyist* 32(10):30-33. June 1984. SFA 29(3)

84-002176 Krekorian, C. O. FIELD OBSERVATIONS OF THE SPLASHING CHARACID, *COPEINA ARNOLDI*, IN GUYANA. *Natl. Geogr. Soc. Res. Rep.* 14:381-384. 1982. SFA 29(3)
[Calif. State Univ., San Diego]

84-002177 Kuo, C. and S. Tanaka. MATURATION AND SPAWNING OF HOKI *MACRURONUS NOVAEZELANDIDAE* (HECTOR) IN WATERS AROUND NEW ZEALAND. *Bull. Jpn. Soc. Sci. Fish.* 50(3):397-402. Mar. 1984. SFA 29(3)
[Dep. Fish. Biol., Taiwan Fish. Res. Inst., Keelung, Taiwan, R.O.C.]

84-002178 Kwain, E. and E. Thomas. THE FIRST EVIDENCE OF SPRING SPAWNING BY CHINOOK SALMON IN LAKE SUPERIOR. *N. Am. J. Fish. Manage.* 4(2):227-228. 1984. SFA 29(3)
[Ontario Minist. Nat. Resour., P.O. Box 130, Sault Ste. Marie, ON P6A 5L5, Canada]

84-002179 Lindquist, D. G.; J. R. Shute; P. W. Shute and L. M. Jones. SELECTION OF SITES FOR EGG DEPOSITION AND SPAWNING DYNAMICS IN THE WACCAMAW DARTER. *Environ. Biol. Fishes* 11(2):107-112. 24 Aug. 1984. SFA 29(3)
[Dep. Biol. Sci., Univ. N.C., Wilmington 28406] We provided 93 experimental spawning covers for the waccamaw darter. We grouped the covers (3 sizes of slate and one of the concave tile) in three arrangements at six Lake Waccamaw

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC. (CONTINUED)

84-002179 CONTINUED locations to separate the variables of water depth, distance from shore, cover density and cover type. Tag returns of marked males suggest low fidelity for nest sites. Egg production under the 3 different sizes of slate was not significantly different. Egg production under the tile was significantly less than that under the slates. Egg production was significantly higher off the undeveloped southeastern shore in 2 m of water and lowest at the shallowest location with the highest experimental cover density. The number of eggs in nest is positively correlated with male size. We conclude that medium size slate covers placed in a linear arrangement in 2 m of water on a mixed sand bottom result in the highest egg production for the waccamaw darter.

84-002180 Mansfield, P. J. REPRODUCTION BY LAKE MICHIGAN FISHES IN A TRIBUTARY STREAM. *Trans. Am. Fish. Soc.* 113(2):231-237. Mar. 1984. SAF 29(3)
[Great Lakes Res. Div., Inst. Sci. Technol., Univ. Mich., Ann Arbor 48109]

84-002181 Matsuyama, M. and S. Matsuura. [THE MULTIPLE SPAWNING IN LANDLOCKED DWARF AYU *PLECOGLOSSUS ALTIVELIS* IN LAKE BIWA.] *Bull. Jpn. Soc. Sci. Fish.* 50(2):183-187. Feb. 1984. In Japanese with English summ. SFA 29(3)
[Dep. Fish., Fac. Agric., Kyushu Univ., Hakozaki, Higashi, Fukuoka 812, Japan]

84-002182 Matsuyama, M. and S. Matsuura. [THE MODE OF OVARIAN MATURATION AND SPAWNING OF THE LANDLOCKED DWARF AYU *PLECOGLOSSUS ALTIVELIS* IN LAKE BIWA.] *Bull. Jpn. Soc. Sci. Fish.* 50(2):225-231. Feb. 1984. In Japanese with English summ. SFA 29(3)
[Dep. Fish., Fac. Agric., Kyushu Univ., Hakozaki, Higashi, Fukuoka 812, Japan]

84-002183 McAllister, C. T.; M. C. Wooten and T. L. King. OBSERVATIONS ON SIZE AND FECUNDITY OF THE LEAST BROOK LAMPREY, *LAMPETRA AEPYPTERA* (ABBOTT), FROM NORTHCENTRAL ARKANSAS. *Proc. Ark. Acad. Sci.* 35:86-87. 1981. SFA 29(3)
[Dep. Biol. Sci., North Tex. State Univ., Denton 76203]

84-002184 Middaugh, D. P. and M. J. Hemmer. SPAWNING OF THE TIDEWATER SILVERSIDE, *MENIDIA PENINSULAE* (GOODE AND BEAN), IN RESPONSE TO TIDAL AND LIGHTING SCHEDULES IN THE LABORATORY. *Estuaries* 7(2):139-148. June 1984. SFA 29(3)
[U.S. EPA, Gulf Breeze Environ. Res. Lab., Sabine Island, Gulf Breeze, FL 32561] Tidewater silversides, *Menidia peninsulae* (Goode and Bean) were maintained in 1.3m diameter holding tanks in identical laboratory recirculating systems. During two weeks under constant conditions (a current velocity of 8 cm per s and continuous illumination, 24L:0D) there was a low relative frequency of arrhythmic spawning. In the subsequent two-week period, fish in one pair of tanks were maintained under the singular influence of twice daily interruptions in current velocity (8 to 0 cm per s at 0600-0700 and 1800-1900) with continuous illumination. The relative frequency of spawning remained low and there was no evidence of a daily spawning rhythm. However, the mean number of eggs per spawn increased substantially. Fish in the second holding system were subjected to a diel light cycle of 13L:11D with a constant current veolocity of 8 cm per s for two weeks. The relative frequency of spawning remained low, and there was no

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC. (CONTINUED)

84-002184 CONTINUED indication of spawning rhythmicity; moreover, there was only a slight increase in the mean number of eggs per spawn. During the third two-week period, fish in the first pair of tanks were provided a 13L:11D diel light cycle, in conjunction with preexisting twice daily interruptions in current velocity; those in the second pair of tanks were provided twice daily interruptions in current velocity in conjunction with the preexisting 13L:11D light cycle. Under the combined influence of interrupted current velocity and diel light cycle cues, there was a marked increase in the relative frequency of spawning in both pairs of tanks. Fish manifested a discernible spawning periodicity, spawns typically occurred between 1800 and 2400; the mean number of eggs per spawn also increased. When fish returned to constant conditions, current velocity 8 cm per s and 24L:0D for two weeks, the frequency of spawning decreased and there was no indication of a spawning periodicity. Results of another experiment (interrupted current at 1200 to 1300 and 2400 to 0100 with a 13L:11D light cycle) indicated gradual expression of a tidal spawning rhythm during nighttime, 2400 to 0359. Our laboratory results indicate that *M. peninsulae* is predominantly a nocturnal spawner and that spawning coincides with interruptions in current velocities.

84-002185 Mousseau, T. A. POLYGAMY AS A FUNCTION OF NEST SITE LIMITATION IN THE SLIMY SCULPIN. *Bull. Ecol. Soc. Am.* 63(2):125. June 1982. Abstract only. SFA 29(3)
[Erindale Campus, Univ. Toronto, Mississauga, ON, Canada]

84-002186 Mulford, C. J. LOCATION AND DESCRIPTION OF STRIPED BASS SPAWNING GROUNDS, BRAZOS RIVER, TEXAS. *Annu. Proc. Tex. Chap. Am. Fish. Soc.* 2:73-87. 1980. SFA 29(3)
[Tex. Parks Wildl. Dep., Fort Worth 76114]

84-002187 Nair, J. R. and N. B. Nair. STUDIES ON THE BREEDING BIOLOGY OF THE TROPICAL GLASSY PERCHLET *CHANDA* (=*AMBASSIS*) *COMMERSONII* (CUV. & VAL.) (PERCIFORMES: CENTROPOMIDAE). *Zool. Anz.* 212(3-4):240-256. 1984. SFA 29(3)
[Dep. Aquatic Biol. Fish., Univ. Kerala, Beach, P.O. Trivandrum, Kerala, India]

84-002188 Nazarov, N. A. DATA ON THE REPRODUCTION OF *ALEPOCEPHALUS BAIRDI* (ALEPOCEPHALIDAE) FROM THE NORTHEASTERN ATLANTIC. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 23(5):29-35. 1983. SFA 29(3)
[AtlanNIRO, Kaliningrad, USSR]

84-002189 Orr, T. M. and N. E. Milward. REPRODUCTION AND DEVELOPMENT OF *NEOSILURUS ATER* (PERUGIA) AND *NEOSILURUS HYRTLII* STEINDACHNER (TELEOSTEI: PLOTOSIDAE) IN A TROPICAL QUEENSLAND STREAM. *Aust. J. Mar. Freshwater Res.* 35(2):187-195. 1984. SFA 29(3)
[Zool. Dep., James Cook Univ. North Queensland, P.O., James Cook Univ., Qld 4811, Australia]

84-002190 Oulasvirta, P.; J. Rissanen and R. Parmanne. SPAWNING OF BALTIC HERRING (*CLUPEA HARENGUS MEMBRAS*) IN THE WESTERN PART OF THE GULF OF FINLAND. *Int. Counc. Explor. Sea* C.M. 1983/J:24. 31p. 1983. In English with French summ. SFA 29(3)
[Tvärminne Zool. Stn., SF-10850 Tvärminne, Finland]

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC. (CONTINUED)

84-002191 Penlington, B. P. LAKE-SHORE SPAWNING OF RAINBOW TROUT AT LAKE ROTOMA, NEW ZEALAND. *N. Z. J. Mar. Freshwater Res.* 17(4):349-355. 1983. SFA 29(3)

[Fish. Res. Div., Minist. Agric. Fish., P.O. Box 951, Rotorua, New Zealand] The presence of suitable gravel size alone can stimulate female rainbow trout (*Salmo gairdneri*) to excavate nests for spawning on the shores of Lake Rotoma. Emergent fry result from lake-shore spawning, and could contribute significantly to the trout fishery in Lake Rotoma. Lake-shore spawning could be enhanced by the use of stable artificial spawning beds that have adequate depth and appropriate sizes of gravel.

84-002192 Quddus, M. M. A.; M. Shimizu and Y. Nose. SPAWNING AND FECUNDITY OF TWO TYPES OF *HILSO ILISHA* IN BANGLADESH WATERS. *Bull. Jpn. Soc. Sci. Fish.* 50(2):177-181. Feb. 1984. SFA 29(3)

[Dep. Zool., Dhaka Univ., Dhaka, Bangladesh]

84-002193 Richter, H. SPAWNING THE WEDGE-SPOT HARLEQUIN, *RASBORA HENGELI*. *Trop. Fish Hobbyist* 32(11):31-35. July 1984. SFA 29(3)

84-002194 Sly, P. G. and C. C. Widmer. LAKE TROUT (*SALVELINUS NAMAYCUSH*) SPAWNING HABITAT IN SENECA LAKE, NEW YORK. *J. Great Lakes Res.* 10(2):168-189. 1984. SFA 29(3)

[Can. Cent. Inland Waters, P.O. Box 5050, Burlington, ON L7R 4A6, Canada] Lake trout from Seneca Lake provide an important source of stock for Great Lakes rehabilitation but the lake trout in Seneca Lake have been hatchery supported, themselves, for many years. Hatchery catch data show a continued decline in lake trout population and this is assumed to reflect changes in hatchery stocking, fishing pressure, and lamprey predation. A commensurate increase in the smelt population, since 1973, may have also contributed to the decrease of natural recruitment by lake trout. No indication of reduced egg survival was found in the hatchery which might be related to lake contamination effects. Our survey observations (1980-81) indicate that the lower parts of deep water cobble gravels have become much degraded by fine particulates, making such sites unsuitable for spawning lake trout. It is thought that natural replacement in Seneca Lake is strongly dependent on successful hatch of eggs laid at depths of 25 to 35 m, but the observed relationship between egg deposition and optimal thermal conditions seems to be anomalous. Since no controlling relationships was found between long-term decline of the lake trout population and climatic variation, it is believed that degradation of lake spawning sites has strongly influenced natural recruitment.

84-002195 Spanovskaya, V. D. and L. N. Soloninova. THE FECUNDITY OF PIKE, *ESOX LUCIUS* (ESOCIDAE). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 23(5):75-83. 1983. SFA 29(3)

[KazNIIRKh, Alma-Ata, USSR]

84-002196 Tómasson, T.; J. A. Cambray and P. B. N. Jackson. REPRODUCTIVE BIOLOGY OF FOUR LARGE RIVERINE FISHES (CYPRINIDAE) IN A MAN-MADE LAKE, ORANGE RIVER, SOUTH AFRICA. *Hydrobiologia* 112(3):179-195. 30 May 1984. SFA 29(3)

[Inst. Freshwater Fish., Hólar i Hjaltadal, 551 Saudárkrókur, Iceland.]

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC. (CONTINUED)

84-002197 Thomas, J. L. and R. V. Kilambi. MATURATION, SPAWNING PERIOD, AND FDCUNDITY OF THE WHITE CRAPPIE, *POMOXIS ANNULARIS* RAFINESQUE, IN BEAVER RESERVOIR, ARKANSAS. *Proc. Ark. Acad. Sci.* 35:70-73. 1981. SFA 29(3)
[Dep. Zool., Univ. Ark., Fayetteville 72701]

84-002198 Tseng, W. Y. and K. L. Chan. THE REPRODUCTIVE BIOLOGY OF THE RABBITFISH IN HONG KONG. *Proc. Annu. Meet. World Maricult. Soc.* 13:313-321. 1982. SFA 29(3)
[Mar. Sci. Lab., Dep. Biol., Chinese Univ. Hong Kong, Shatin, N.T., Hong Kong]

84-002199 Van den Berghe, E. P. and M. R. Gross. FEMALE SIZE AND NEST DEPTH IN COHO SALMON *(ONCORHYNCHUS KISUTCH). Can. J. Fish. Aquatic Sci.* 41(1):204-206. Jan. 1984. In English with French summ. SFA 29(3)
[M.R. Gross: Dep. Biol. Sci., Simon Fraser Univ., Burnaby, BC V5A 1S6, Canada]

MOVEMENTS, SEASONAL AND DEPTH DISTRIBUTION, ETC.

84-002200 Arawomo, G. A. O. THE DISTRIBUTION OF JUVENILE TROUT IN LOCH LEVEN, KINROSS, SCOTLAND. *Arch. Hydrobiol.* 100(1):123-135. 1984. SFA 29(3)
[Dep. Zool., Univ. Ife, Ile-Ife, Nigeria] The distribution of juvenile trout in Loch Leven was studied by seining, trawling and gillnetting between October 1974 and December 1976. Only gillnetting caught juvenile trout in significant numbers in the offshore areas of the loch. From gillnets set along three traverses on the loch, juvenile trout were found to be concentrated in the offshore, above the mud zone of the loch. During the summer period, gillnet captures of juvenile trout were found to increase with increasing depth, reaching a maximum concentration at the deepest part of each traverse. However, during the winter, juvenile trout appeared to be evenly distributed with no clear area of concentration. Though there were a few areas of overlap, juvenile trout concentrations seem to be separated from the adult trout, perch and pike populations in the loch.

84-002201 Aro, E. and B. Sjöblom. THE MIGRATION OF FLOUNDER IN THE NORTHERN BALTIC SEA. *Int. Counc. Explor. Sea* C.M. 1983/J:26. 12p. 1983. In English with French summ. SFA 29(3)
[Finn. Game Fish. Res. Inst., Fish. Div., P.O. Box 193, SF-00131 Helsinki 13, Finland]

84-002202 Baugh, T. M. and J. E. Deacon. DAILY AND YEARLY MOVEMENT OF THE DEVIL'S HOLE PUPFISH *CYPRINODON DIABOLIS* WALES IN DEVIL'S HOLE, NEVADA. *Great Basin Nat.* 43(4):592-596. 31 Oct. 1983. SFA 29(3)
[Dep. Biol. Sci., Univ. Nev., Las Vegas 89154] Past observations and ongoing population surveys indicate daily and yearly vertical movement of the Devil's Hole pupfish, *Cyprinodon diabolis* Wales, within the upper 27m of the water column in Devil's Hole, Nevada. This movement involves occupying and leaving a 5 by 3.5m rock shelf during daily and yearly periods of maximum light intensity.

MOVEMENTS, SEASONAL AND DEPTH DISTRIBUTION, ETC. (CONTINUED)

84-002203 Cheek, T. E. DISTRIBUTION AND HABITAT SELECTION OF ADULT STRIPED BASS, *MORONE SAXATILIS* (WALBAUM), IN WATTS BAR RESERVOIR, TENNESSEE. *Tenn. Tech. J.* 18:54. 1983. Abstract only. SFA 29(3)

84-002204 Forster, G. R. THE DISTRIBUTION OF FISHES ON THE OUTER REEF SLOPES OF ALDABRA (INDIAN OCEAN) IN RELATION TO BOTTOM TEMPERATURES. *Environ. Biol. Fishes* 10(3):129-136. 15 Apr. 1984. SFA 29(3)
[Mar. Biol. Assoc., Plymouth PL1 2PB, England]

84-002205 Girsa, I. I. and V. N. Zhuravel. BEHAVIORAL RHYTHM OF SOME FISHES IN THE COASTAL REGION OF THE WHITE SEA. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 23(5):138-142. 1983. SFA 29(3)
[IEMEZH, Moscow, USSR]

84-002206 Guillory, V. and J. Roussel. SEASONAL AND AREAL ABUNDANCE OF GULF MENHADEN IN LOUISIANA ESTUARIES. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 35:365-371. 1981. SFA 29(3)
[La. Dep. Wildl. Fish., Grand Isle 70358]

84-002207 Harcup, M. F.; R. Williams and D. M. Ellis. MOVEMENTS OF BROWN TROUT, *SALMO TRUTTA* L., IN THE RIVER GWYDDON, SOUTH WALES. *J. Fish Biol.* 24(4):415-426. Apr. 1984. SFA 29(3)
[Welsh Water Auth., Hawthorn Rise, Haverfordwest, Dyfed SA61 2BH, Wales] Movements of native brown trout, *Salmo trutta*, 1+ and older, were limited with up to 93% of recaptured marked fish occupying sites where previously caught. Movements >50 m were rare with the majority <15 m. Between sampling occasions, the population could be separated into a static component and a smaller mobile component but there was no evidence of a permanently mobile group. The proportion of mobile native fish increased after stocking with hatchery-reared trout. Displaced native trout (1+ and older) showed the ability to home from 75 m upstream to 111 m downstream of a release site.

84-002208 Haug, T.; E. Kjørsvik and P. Solemdal. VERTICAL DISTRIBUTION OF ATLANTIC HALIBUT *(HIPPOGLOSSUS HIPPOGLOSSUS)* EGGS. *Can. J. Fish. Aquatic Sci.* 41(5):798-804. May 1984. In English with French summ. SFA 29(3)
[Dep. Mar. Biol., Tromsø Mus., Univ. Tromsø, P.O. Box 2550, N-9001 Tromsø, Norway]

84-002209 Inagake, D. and T. Hirano. HORIZONTAL DISTRIBUTION OF THE JAPANESE SARDINE IN RELATION TO OCEANIC FRONT AT THE PURSE SEINE FISHING GROUNDS SOUTHEAST OF HOKKAIDO. *Bull. Jpn. Soc. Sci. Fish.* 50(4):577-589. Apr. 1984. SFA 29(3)
[Ocean Res. Inst., Univ. Tokyo, Minamidai, Nakano, Tokyo 164, Japan]

84-002210 Inoue, M.; T. Arimoto and W. G. Ning. [UPSTREAM MOVEMENT OF MARINE FISHES UNDER BRIGHT AND DARK CONDITIONS.] *Bull. Jpn. Soc. Sci. Fish.* 50(1):63-69. Jan. 1984. In Japanese with English summ. SFA 29(3)
[Tokyo Univ. Fish., Konan, Minato, Tokyo 108, Japan]

84-002211 Kaufman, L. S. and J. P. Ebersole. MICROTOPOGRAPHY AND THE ORGANIZATION OF TWO ASSEMBLAGES OF CORAL REEF FISHES IN THE WEST INDIES. *J. Exp. Mar. Biol. Ecol.* 78(3):253-268. 21 June 1984. SFA 29(3)
[New England Aquarium, Boston, MA 02110]

MOVEMENTS, SEASONAL AND DEPTH DISTRIBUTION, ETC. (CONTINUED)

84-002212 Kuo, C. and S. Tanaka. DISTRIBUTION AND MIGRATION OF HOKI *MACRURONUS NOVAEZELANDIDAE* (HECTOR) IN WATERS AROUND NEW ZEALAND. *Bull. Jpn. Soc. Sci. Fish.* 50(3):391-396. Mar. 1984. SFA 29(3)
[Dep. Fish. Biol., Taiwan Fish. Res. Inst., Keelung, Taiwan, R.O.C.]

84-002213 Müller, K. and L. Karlsson. THE BIOLOGY OF THE GRAYLING, *THYMALLUS THYMALLUS* L., IN COASTAL AREAS OF THE BOTHNIAN SEA. *Aquilo* 22:65-68. 1983. SFA 29(3)
[Dep. Ecol. Zool., Univ. Umeå, Umeå, S-90187, Sweden]

84-002214 Müller, K. LUNAR PERIODICITY OF SEAWARD MIGRATING JUVENILE BURBOT. A SHORT COMMUNICATION. *Aquilo* 22:147-148. 1983. SFA 29(3)
[Dep. Ecol. Zool., univ. Umeå, S-90187 Umeå, Sweden]

84-002215 McEachron, L. W. and G. C. Matlock. MOVEMENT OF SPOTTED SEATROUT (*CYNOSCION NEBULOSUS*) TAGGED IN BASTROP BAYOU, TEXAS. *Annu. Proc. Tex. Chap. Am. Fish. Soc.* 3:64-82. 1981. SFA 29(3)
[Tex. Parks Wildl. Dep., P.O. Box 1707, Rockport 78382]

84-002216 Muth, R. T. and J. C. Schmulbach. DOWNSTREAM TRANSPORT OF FISH LARVAE IN A SHALLOW PRAIRIE RIVER. *Trans. Am. Fish. Soc.* 113(2):224-230. Mar. 1984. SFA 29(3)
[Larval Fish Lab., Dep. Fish. Wildl. Biol., Colo. State Univ., Fort Collins 80523]

84-002217 Norcross, B. L. and R. F. Shaw. OCEANIC AND ESTUARINE TRANSPORT OF FISH EGGS AND LARVAE: A REVIEW. *Trans. Am. Fish. Soc.* 113(2):153-165. Mar. 1984. SFA 29(3)
[Va. Inst. Mar. Sci., Sch. Mar. Sci., Coll. William and Mary, Gloucester Point, VA 23062]

84-002218 Robblee, M. B. and J. C. Zieman. DIEL VARIATION IN THE FISH FAUNA OF A TROPICAL SEAGRASS FEEDING GROUND. *Bull. Mar. Sci.* 34(3):335-345. May 1984. SFA 29(3)
[South Fla. Res. Cent., Everglades Natl. Park, P.O. Box 279, Homestead 33030]

84-002219 Sloane, R. D. INVASION AND UPSTREAM MIGRATION BY GLASS-EELS OF *ANGUILLA AUSTRALIS AUSTRALIS* RICHARDSON AND *A. REINHARDTII* STEINDACHNER IN TASMANIAN FRESHWATER STREAMS. *Aust. J. Mar. Freshwater Res.* 35(1):47-59. 1984. SFA 29(3)
[Dep. Zool., Univ. Tasmania, G.P.O. Box 252C, Hobart, Tasmania 7001, Australia]

84-002220 Sloane, R. D. UPSTREAM MIGRATION BY YOUNG PIGMENTED FRESHWATER EELS (*ANGUILLA AUSTRALIS AUSTRALIS* RICHARDSON) IN TASMANIA. *Aust. J. Mar. Freshwater Res.* 35(1):61-73. 1984. SFA 29(3)
[Dep. Zool., Univ. Tasmania, G.P.O. Box 252C, Hobart, Tasmania 7001, Australia]

MOVEMENTS, SEASONAL AND DEPTH DISTRIBUTION, ETC. (CONTINUED)

84-002221 Tytler, P. and F. G. T. Holliday. TEMPORAL AND SPATIAL RELATIONSHIPS IN THE MOVEMENTS OF LOCH DWELLING BROWN TROUT, *SALMO TRUTTA* L., RECORDED BY ULTRASONIC TRACKING FOR 24 HOURS. *J. Fish Biol.* 24(6):691-702. June 1984. SFA 29(3)

[Dep. Biol. Sci., Univ. Stirling, Stirling, Scotland] Ultrasonic telemetry was used to record simultaneously, over one complete April day, the movements of four adult brown trout, *Salmo trutta*, which were residents of a shallow Scottish loch. The daily movements were generally along linear tracks. The home ranges are described as standard and 95% confidence ellipses. The area of standard ellipses ranged from 330 to 633 m^2 while 95% confidence ellipses were larger, ranging from 513 to 979 m^2. The distances separating individuals, which ranged from 1 to 70 m, were greatest during peaks of activity. Although there was considerable spatial overlap of individual home ranges, the trout were not within visual range for most of the tracking period. Close encounters (proximity <2.5 m) occurred most frequently and lasted longest at night. It is concluded, from this study, that brown trout in small productive lochs are solitary but may hold temporary station within widely overlapping home ranges.

FOODS/FEEDING

84-002222 Allan, J. D. THE INFLUENCE OF PREDATION ON INVERTEBRATE COMMUNITIES IN STREAMS. *Bull. Ecol. Soc. Am.* 62(2):123. June 1981. Abstract only. SFA 29(3)

[Univ. Md., College Park]

84-002223 Anderson, O. OPTIMAL FORAGING BY LARGEMOUTH BASS IN STRUCTURED ENVIRONMENTS. *Ecology* 65(3):851-861. June 1984. SFA 29(3)

[Zool. Dep., Mich. State Univ., East Lansing 48824] The effects of different densities of vegetation on the foraging behavior of largemouth bass, *Micropterus salmoides*, were examined in the laboratory. Prey encounter rates and handling times and the swimming velocities of the bass while searching for and handling prey were significantly influenced by changes in the amount of vegetation. An optimal-foraging model was then used to predict selection by the bass in two environments with identical prey communities but different densities of macrophytes. Consumption of prey by the bass corresponded closely with the predictions of the model. Diet breadths differed between environments, with bass in the sparse-vegetation habitat being more specialized. There was less variance in the foraging behavior of bass in sparse vegetation, and such fish adopted a particular diet more quickly than did their counterparts in dense vegetation.

84-002224 Barbieri, G. and M. C. Barbieri. NOTE ON NUTRITIONAL DYNAMICS OF *GYMNOTUS CARAPO* (L.) FROM THE LOBO RESERVOIR, SÃO PAULO STATE, BRAZIL. *J. Fish Biol.* 24(4):351-355. Apr. 1984. SFA 29(3)

[Dep. Biol. Sci., Fed. Univ. São Carlos, SP, Brazil]

84-002225 Bordulina, O. D. A METHOD OF FISH IDENTIFICATION ON THE BASIS OF THEIR OSTEOLOGICAL FRAGMENTS FROM PREDATOR STOMACHS. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 23(4):169-170. 1984. SFA 29(3)

[IOAN, Moscow, USSR]

84-002226 Chilton, G.; K. A. Martin and J. H. Gee. WINTER FEEDING: AN ADAPTIVE STRATEGY BROADENING THE NICHE OF THE CENTRAL MUDMINNOW, *UMBRA LIMI*. *Environ. Biol. Fishes* 10(3):215-219. 15 Apr. 1984. SFA 29(3)

FOODS/FEEDING (CONTINUED)

84-002226 CONTINUED
[Dep. Zool., Univ. Manitoba, Winnipeg, MB R3T 2N2, Canada] Mudminnows, *Umbra limi*, were euryphagic carnivores during the ice-free period consuming invertebrates of terrestrial and aquatic origins. In winter, diversity and amount of food eaten were reduced. Age 0 fish consumed aquatic invertebrates as did males aged 1 and 2+ but females aged 1 and 2+ consumed mainly fishes. In the laboratory mudminnows were able to capture small fish at temperatures of 12.6°C and less. Their rates of digestion of fish prey varied directly with temperature and estimates of time for 100% gastric evacuation ranged from 161 h at 1.1°C to 26 h at 12.6°C. The ability to forage actively during winter and to digest food relatively rapidly at cold temperatures are seen as mechanisms to broaden the niche along dimensions of resources utilized and time, thereby increasing the chances of survival and reproduction in an environment with high temporal heterogeneity.

84-002227 Clements, W. H. and R. J. Livingston. PREY SELECTIVITY OF THE FRINGED FILEFISH, *MONACANTHUS CILIATUS* (PISCES: BALISTIDAE). *Bull. Ecol. Soc. Am.* 63(2):115. June 1982. Abstract only. SFA 29(3)
[Fla. State Univ., Tallahassee] Observed patterns of prey selectivity are dependent on both the predator's preferences and the relative encounter rates of prey species. In order to distinguish between these two components, laboratory experiments were conducted to measure prey selectivity of the fringed filefish, *Monacanthus ciliatus*, for two species of gammarid amphipods (*Lembos* sp. and *Elasmopus levis*). When equal numbers of the two species were present in an aquarium, *Lembos* sp. was disproportionately consumed by *M. ciliatus*. In experiments where the two species were encountered simultaneously, the fish failed to discriminate between them. Attack rates were also measured for the two species separately. The number of *Lembos* sp. attacked per 5 minutes of search time was significantly greater than the number of *E. levis* attacked, supporting the hypothesis that the observed patterns of selectivity were the result of different encounter rates of the two species.

84-002228 Colgan, P. and B. Silburt. FEEDING BEHAVIOUR OF THE CENTRAL MUDMINNOW, *UMBRA LIMI*, IN THE FIELD AND LABORATORY. *Environ. Biol. Fishes* 10(3):209-214. 15 Apr. 1984. SFA 29(3)
[Biol. Dep., Queen's Univ., Kingston, ON K7L 3N6, Canada] The field component of this study compared feeding preferences of *Umbra limi* with available resources in the environment. The mudminnows preferred benthic coleopterans, anisopterans, and amphipods while avoiding planktonic and other benthic food types. The laboratory component tested for possible switching behaviour by offering different ratios of two food types (*Enchytraeus* worms and *Culex* larvae). Both components indicated a benthic feeding preference in mudminnows. Although preferences were variable across individuals, switching did not occur, a result consistent with recent predictions on predatory behaviour. Feeding patterns reflected individual differences among fish, runs of feeding on one food type, and constancy in in the total number of the two food types eaten.

84-002229 Cyrus, D. P. and S. J. M. Blaber. THE FEEDING ECOLOGY OF GERREIDAE (TELEOSTEI) IN THE KOSI SYSTEM, WITH SPECIAL REFERENCE TO THEIR SEASONAL DIET. *Lammergeyer* No. 32. p.35-49. Jan. 1984. SFA 29(3)
[Dep. Zool., Univ. Zululand, P.B. X1001, KwaDelangezwa, 3886, Natal, South Africa]

FOODS/FEEDING (CONTINUED)

84-002230 Dabrowski, K. and R. Bardega. MOUTH SIZE AND PREDICTED FOOD SIZE PREFERENCES OF LARVAE OF THREE CYPRINID FISH SPECIES. *Aquaculture* 40(1):41-46. 1 July 1984. SFA 29(3)
[Inst. Ichthyobiol. Fish., Acad. Agric. Technol., 10-957 Olsztyn-Kortowo, Poland] Mouth size was examined in larvae and juveniles of three cyprinid fish species: grass carp (*Ctenopharyngodon idella* Val.), silver carp (*Hypophthalmichthys molitrix* Rich.) and bighead carp (*Aristichthys nobilis* Rich.). A linear relationship was found between mouth size and the total length of fish, from the initial exogenous feeding stage up to 20-30 mm. Based on the mouth size, the size of the prey which could be consumed was calculated assuming 45° of mouth opening for optimum prey width and 90° for maximum prey width. Food particle size considered to be suitable for commencement of feeding amounted to 50-90 µm for silver carp larvae, 90-150 µm for grass carp larvae and 150-270 µm for bighead carp larvae. These criteria can be applied to moving rotifers and nauplii as well as to the motionless particles of compound, dry diets.

84-002231 Devonald, F. K. EVALUATION OF THE FEEDING SUCCESS OF JACK MACKEREL LARVAE OFF SOUTHERN CALIFORNIA, AND SOME CONTRIBUTING FACTORS. *Ph.D. dissertation, Univ. Calif. (San Diego)* 227p. 1983. From Diss. Abstr. Int. B Sci. Eng. 44(11):3268. May 1984. SFA 29(3)

84-002232 el Moghraby, A. I. and A. Abd el Rahman. FOOD AND FEEDING HABITS OF *LABEO NILOTICUS* (PISCES, CYPRINIDAE) IN JEBEL AULIA RESERVOIR, SUDAN. *Hydrobiologia* 110:327-332. 23 Mar. 1984. SFA 29(3)
[Fish. Hydrobiol. Res. Cent., Khartoum, Sudan]

84-002233 Elliott, E. T.; L. Castanares; D. M. Everett and D. Perlmutter. ZOOPLANKTON RESPONSE TO FISH PREDATION IN PLANKTONIC MICROCOSMS. *Bull. Ecol. Soc. Am.* 62(2):150-151. June 1981. Abstract only SFA 29(3)
[Univ. Ga., Athens]

84-002234 Ferguson, M. O.; A. W. Green and G. C. Matlock. EVALUATION OF THE ACCURACY AND PRECISION OF VOLUNTEERED SIZE DATA FROM TAGGED RED DRUM RETURNS. *N. Am. J. Fish. Manage.* 4(2):181-185. 1984. SFA 29(3)
[Tex. Parks Wildl. Dep., Coastal Fish. Br., 4200 Smith School Rd., Austin 78744] The accuracy and precision of total lengths and weights from recaptured tagged red drum (*Sciaenops ocellatus*) reported by Texas Parks and Wildlife Department (TPWD) biologists, anglers, and commercial fishermen were compared. No differences were found in the total length-weight regressions of data reported by sport and commercial fishermen, but there were significant differences found between data reported by fishermen and data collected by TPWD biologists (F_s = 6.312; $P<0.05$). Fish lengths reported by fishermen were not biased but they were more variable than lengths reported by TPWD due to rounding to the nearest whole or partial English unit. Weights reported by fishermen were more variable than weights reported by TPWD biologists. A significant difference between regression coefficients was found and a comparison of confidence limits of the regression lines showed that fishermen overestimated the weight of small fish: therefore, growth estimates calculated from red drum weights provided by fishermen will be biased. TPWD total length data provided the most precise data for growth estimates.

84-002235 Fraser, D. F. and R. Cerri. EXPERIMENTAL EVALUATION OF PREDATOR-PREY RELATIONSHIPS IN A PATCHY ENVIRONMENT: CONSEQUENCES FOR HABITAT USE PATTERNS IN MINNOWS. *Bull. Ecol. Soc. Am.* 62(2):151. June

FOODS/FEEDING (CONTINUED)

84-002235. CONTINUED 1981. Abstract only. SFA 29(3)
[Siena Coll., Loudonville, NY] An experimental study, using juvenile *Semotilus atromaculatus* (Pisces: Cyprinidae) and *Rhinichthys atratulus* (Pisces: Cyprinidae) as prey and adults of the former as predators, was conducted in a semi-natural artificial stream. The study evaluates the interaction of predator presence, habitat structural complexity and time of day in determining use patterns of prey. Prey of both species actively avoid locations in the artificial stream that contain predators. However, structural complexity and daylight each have a mediating effect on the response of the prey fish to the presence of predators. Prey more often enter predator locations when structure is present or during daylight hours. The study offers an explanation for the variability in relative abundances of predators and prey fish in habitat patches of headwater streams, by relating patch use by prey to habitat structural complexity and diel activity.

84-002236 Fraser, D. F. and E. E. Emmons. BEHAVIORAL RESPONSE OF BLACKNOSE DACE (*RHINICHTHYS ATRATULUS*) TO VARYING DENSITIES OF PREDATORY CREEK CHUB (*SEMOTILUS ATROMACULATUS*). *Can. J. Fish. Aquatic Sci.* 41(2):364-370. Feb. 1984. In English with French summ. SFA 29(3)
[Dep. Biol. Sci., Bowling Green State Univ., Bowling Green, OH 43403]

84-002237 Gilliland, E. R. and M. D. Clady. DIET OVERLAP OF STRIPED BASS X WHITE BASS HYBRIDS AND LARGEMOUTH BASS IN SOONER LAKE, OKLAHOMA. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 35:317-330. 1981. SFA 29(3)
[Okla. Dep. Wildl. Conserv., Fish. Res. Lab., 1416 Planck St., Norman 73069]

84-002238 Goeman, T. J.; D. R. Helms and R. C. Heidinger. COMPARISON OF OTOLITH AND SCALE AGE DETERMINATIONS FOR FRESHWATER DRUM FROM THE MISSISSIPPI RIVER. *Proc. Iowa Acad. Sci.* 91(2):49-51. June 1984. SFA 29(3)
[Environ. Res. Technol., Inc., P.O. Box 315, Albany, IL 61230] A comparative aging study was conducted using scales and otoliths from 123 freshwater drum collected in Pool 14 of the Mississippi River. Two independent readings by 2 investigators resulted in full agreement on ages assigned using otoliths, but only 64% agreement using the scale method. A final age was determined for the remaining scale samples based on the most commonly assigned age. However, there was no agreement on assigned ages for 12% of the scales examined. Otoliths were validated as an accurate method for aging freshwater drum by age frequency histograms for 3 consecutive years. The marked 3-year periodicity in appearance of strong year-classes allowed these strong year-classes to be followed through successive years of study providing a check on the reliability of this aging method. Scales were concluded to be only 61% reliable for aging freshwater drum. The observed trend indicated that assigned ages using scales were commonly overestimated for fish age 9 and younger and underestimated for older fish.

84-002239 Grobecker, D. B. FUNCTIONAL MORPHOLOGY AND BEHAVIORAL ECOLOGY OF ANTENNARIID ANGLERFISHES. *Ph.D. dissertation, Univ. Wash.* 1983. From Diss. Abstr. Int. B Sci. Eng. 44(11):3327. May 1984. SFA 29(3)

84-002240 Hay, M. E. CORAL REEF ECOLOGY: HAVE WE BEEN PUTTING ALL OF OUR HERBIVORES IN ONE BASKET? *Bioscience* 34(5):323-324. May 1984. SFA 29(3)
[Univ. N.C. Inst. Mar. Sci., Morehead City 28557]

FOODS/FEEDING (CONTINUED)

84-002241 Hay, M. E. PATTERNS OF FISH AND URCHIN GRAZING ON CARRIBEAN CORAL REEFS: ARE PREVIOUS RESULTS TYPICAL? *Ecology* 65(2):446-454. Apr. 1984. SFA 29(3)
[Univ. N.C. Inst. Mar. Sci., Morehead City 28557]

84-002242 Hayashi, T. WHAT INSIGHTS CAN BE GAINED FROM STOMACH CONTENTS? *J. Fac. Appl. Biol. Sci. Hiroshima Univ.* 22(2):271-302. Dec. 1983. In Japanese with English summ. SFA 29(3)
[Lab. Ecol., Fac. Appl. Biol. Sci., Hiroshima Univ., Fukuyama, Japan]

84-002243 Henry, R. L. III and S. M. Bartell. PREY SIZE UTILIZATION IN A COMMUNITY OF SOUTHEASTERN FISHES. *Bull. Ecol. Soc. Am.* 62(2):151. June 1981. Abstract only. SFA 29(3)
[Univ. Ga., Athens] The prey size relationships of eight dominant fishes in the Satilla River, Georgia, were examined from December 1974 to November 1975. Fishes were collected by electroshock once every two months and prey utilization estimated by gut analysis. Three types of carnivory were observed: 1)Piscivores (Chain Pickeral and Largemouth Bass), 2)Insectivores (Bluegill, Redbreast, Spotted Sunfish, Pirate Perch and Spotted Sucker), and 3)Crayfish feeders (Warmouth and Largemouth Bass). Within the piscivore and crayfish feeding groups clear prey size differences were found. Among the insectivores these differences were less evident but still observable. In general, the rank from largest to smallest prey size was as follows: Chain Pickeral, Largemouth Bass, Warmouth, Redbreast, Bluegill, Spotted Sunfish, Pirate Perch and Spotted Sucker.

84-002244 Hershey, A. E. BENTHIC COMMUNITY STRUCTURE IN AN ARCTIC LAKE: FISH PREDATION, FORAGING STRATEGIES, AND PREY REFUGIA. *Ph.D. dissertation, N.C. State Univ.* 116p. 1983. From Diss. Abstr. Int. B Sci. Eng. 44(10):2994. Apr. 1984. SFA 29(3)

84-002245 Hyvärinen, R. and T. Valtonen. THE DIET OF VENDACE, *COREGONUS ALBULA* L. IN THE NORTHEASTERN BOTHNIAN BAY. *Aquilo* 22:13-18. 1983. SFA 29(3)
[Perämeri Res. Stn., Univ. Oulu, Oulu, Finland]

84-002246 Irvine, G. V. GRAZER-PLANT INTERACTION: THE INCREASE IN ABUNDANCE, REPRODUCTION AND PERSISTENCE OF A PREFERRED ALGA BY A DAMSELFISH. *Bull. Ecol. Soc. Am.* 63(2):124. June 1982. Abstract only. SFA 29(3)
[Univ. Calif., Santa Barbara]

84-002247 Ivanova, M. N. and A. M. Lopatko. FEEDING BEHAVIOR OF PIKE, *ESOX LUCIUS* (ESOCIDAE), LARVAE FROM THE PROGENY OF A SINGLE PAIR OF SPAWNERS. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 23(4):171-173. 1983. SFA 29(3)
[Inst. Biol. Inland Waters, Acad. Sci. USSR, Borok, Yaroslavl Dist., USSR]

84-002248 Johnson, D. M.; R. J. Merrill, R. E. Bohanan and C. N. Watson. PREDATION BY FISH AND DRAGONFLY LARVAE IN A LENTIC ALLOCHTHONOUS DETRITUS HABITAT. *Bull. Ecol. Soc. Am.* 62(2):152. June 1981. Abstract only. SFA 29(3)
[Tenn. State Univ., Johnson City]

FOODS/FEEDING (CONTINUED)

84-002249 Johnson, J. H. COMPARATIVE DIETS OF PLANTED RAINBOW TROUT (*SALMO GAIRDNERI*) AND SPECKLED DACE (*RHINICHTHYS OSCULUS*) IN A PRAIRIE IMPOUNDMENT IN NORTH CENTRAL IDAHO. *Proc. Annu. Conf. West. Assoc. Fish Wildl. Agencies* 62:611-618. 1982. SFA 29(3)

[Nez Perce Tribe Idaho, Lapwai, ID 83540] The diets of planted rainbow trout (*Salmo gairdneri*) and speckled dace (*Rhinichthys osculus*) were examined from Talmaks Lake, a small, 5-hectare impoundment on the Nez Perce Indian Reservation. Yearling rainbow trout (n=92) were grouped into three size categories (i.e. <250 mm, 250-289 mm, ≥290 mm) based on apparent differences in diet composition. Chironomid larvae were generally the principal prey of trout, although speckled dace were the major dietary component of trout more than 290 mm. Speckled dace (n=285) were grouped into four size categories (i.e. <70 mm, 70-79 mm, 80-89 mm, ≥90mm). Chironomid larvae were the chief prey of speckled dace and were followed in importance by baetid nymphs. Dietary overlap for trout was greatest between fish <250 mm and 250-289 mm and lowest between fish <250 mm and ≥290 mm. Because of minor dietary variation among the size groups of speckled dace, overlap values were high. The data suggest that speckled dace may provide forage for rainbow trout in excess of 290 mm in small lacustrine environments. However, the data also indicate that speckled dace may compete for available food with rainbow trout less than 290 mm.

84-002250 Majkowski, J. and W. S. Hearn. COMPARISON OF THREE METHODS FOR ESTIMATING THE FOOD INTAKE OF A FISH. *Can. J. Fish. Aquatic Sci.* 41(1):212-215. Jan. 1984. In English with French summ. SFA 29(3)

[Div. Fish. Res., CSIRO Mar. Lab., P.O. Box 21, Cronulla, NSW 2230, Australia]

84-002251 Martin, F. D. DIETS OF FOUR SYMPATRIC SPECIES OF *ETHEOSTOMA* (PISCES: PERCIDAE) FROM SOUTHERN INDIANA: INTERSPECIFIC AND INTRASPECIFIC MULTIPLE COMPARISONS. *Environ. Biol. Fishes* 11(2):113-120. 24 Aug. 1984. SFA 29(3)

[Univ. Md. Cent. Environ. Estuarine Stud., Chesapeake Biol. Lab., Solomons 20688]

84-002252 Mauchline, J. and J. D. M. Gordon. OCCURRENCE OF STONES, SEDIMENT AND FISH SCALES IN STOMACH CONTENTS OF DEMERSAL FISH OF THE ROCKALL TROUGH. *J. Fish Biol.* 24(4):357-362. Apr. 1984. SFA 29(3)

[Dunstaffnage Mar. Res. Lab., P.O. Box No. 3, Oban, Argyll PA34 4AD, Scotland]

84-002253 Mittelbach, G. G. PREDATOR-MEDIATED COMPETITION IN TWO SUNFISHES. *Bull. Ecol. Soc. Am.* 63(2):113. June 1982. Abstract only. SFA 29(3)

[Ohio State Univ., Columbus]

84-002254 Mittelbach, G. G. PREDATION AND RESOURCE PARTITIONING IN TWO SUNFISHES (CENTRARCHIDAE). *Ecology* 65(2):499-513. Apr. 1984. SFA 29(3)

[Dep. Zool., Ohio State Univ., Columbus 43210] This study examines the diet and habitat use of two congeneric sunfishes in light of the effects of size-specific predation risk and foraging efficiency. Large bluegills (*Lepomis macrochirus*) and pumpkinseeds (*L. gibbosus*) (>75 mm SL) exhibited distinct diet and habitat separation in three small Michigan lakes. Bluegills foraged primarily on open-water zooplankton (*Daphnia*), while pumpkinseeds specialized on vegetation-dwelling gastropods. These differences

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84-002254 CONTINUED in resource use by large fish were directly related to differences in their functional morphology and foraging ability. In laboratory feeding experiments, pumpkinseeds had significantly lower prey handling times for gastropods than did bluegills. The bluegill, on the other hand, was the more efficient of the two species when feeding on zooplankton (*Daphnia*). In contrast to the large fish, the diets and habitat use of small bluegills and pumpkinseeds (≤ 75 mm SL) were quite similar. Small fish of both species foraged predominantly in the vegetation, and 76-91% of their average seasonal diet was vegetation-dwelling prey (nongastropods). This increase in shared resources among small fish was due to two factors: (1) piscivorous fish restrict small size-classes to the vegetation where they are less vulnerable, and (2) small pumpkinseeds are unable to feed effectively on snails, the adult resource in the vegetation. Laboratory comparisons of the foraging rate of small bluegills and pumpkinseeds on vegetation-dwelling prey, and field measures of the growth rate of each species while occupying the vegetation, indicate that the two species are nearly equal competitors in the juvenile habitat. The two species, however, were not in equal abundance across the study lakes; the ratio of bluegills to pumpkinseeds ranged from 25:1 to 1:1. The pattern in species abundance was directly related to the availability of "adult" resources (snails and zooplankton) in each of the lakes, suggesting that the volume of the competitive refuge experienced by each species at larger sizes is the predominant factor controlling their relative numbers.

84-002255 O'Brien, W. J.; C. Luecke and B. Evans. SEARCH AND CHOICE OF BLUEGILL SUNFISH FOR ZOOPLANKTON PREY. *Bull. Ecol. Soc. Am.* 62(2):150. June 1981. Abstract only. SFA 29(3)
[Univ. Kans., Lawrence]

84-002256 Oliver, J. L. FOOD OF LARVAL YELLOW PERCH IN A SOUTH CAROLINA RESERVOIR RECEIVING HEATED EFFLUENT. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 35:592-597. 1981. SFA 29(3)
[U.S. FWS, 1451 Green Rd., Ann Arbor, MI 48105]

84-002257 Paszkowski, C. A. AN EXPERIMENTAL STUDY OF FORAGING SITE USE IN THE CENTRAL MUDMINNOW AND YELLOW PERCH. *Bull. Ecol. Soc. Am.* 63(2):115. June 1982. Abstract only. SFA 29(3)
[Univ. Wis., Madison]

84-002258 Peterson, C. H. THE CHANGING NATURE OF BENTHIC PREDATION ALONG A GRADIENT IN SEDIMENT SIZE. *Bull. Ecol. Soc. Am.* 62(2):122. June 1981. Abstract only. SFA 29(3)
[Univ. N.C. Chapel Hill]

84-002259 Pikitch, E. K. DIFFERENCES IN FEEDING PATTERNS AMONG THREE AGE GROUPS OF WALLEYE (*STIZOSTEDION VITREUM VITREUM*) IN WESTERN LAKE ERIE. *Proc. Indiana Acad. Sci.* 92:471. 1982(1983). Abstract only. SFA 29(3)
[Dep. Biol., Indiana Univ., Bloomington 47405]

84-002260 Prejs, A. HERBIVORY BY TEMPERATE FRESHWATER FISHES AND ITS CONSEQUENCES. *Environ. Biol. Fishes* 10(4):281-296. 30 May 1984. SFA 29(3)
[Dep. Hydrobiol., Univ. Warsaw, Nowy Swiat 67, 00-046 Warsaw, Poland]

FOODS/FEEDING (CONTINUED)

84-002261 Quammen, M. L. PREDATION BY SHOREBIRDS, FISH, AND CRABS ON INVERTEBRATES IN INTERTIDAL MUDFLATS: AN EXPERIMENTAL TEST. *Ecology* 65(2):529-537. Apr. 1984. SFA 29(3)
[Mar. Sci. Inst., Univ. Calif., Santa Barbara 93106]

84-002262 Robinette, H. R. and S. S. Knight. FOODS OF CHANNEL CATFISH DURING FLOODING OF THE TOMBIGBEE RIVER, MISSISSIPPI. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 35:598-606. 1981. SFA 29(3)
[Dep. Wildl. Fish., Miss. State Univ., Mississippi State 39762]

84-002263 Ryer, C. H. THE ROLE OF PREY SIZE AND AVAILABILITY IN THE PREDATORY STRATEGY OF THE NORTHERN PIPEFISH. *Bull. Ecol. Soc. Am.* 63(2):140. June 1982. Abstract only. SFA 29(3)
[Va. Inst. Mar. Sci., Coll. William and Mary, Gloucester Point, VA] The northern pipefish, *Syngnathus fuscus*, was found to be a dominant predator upon eelgrass *(Zostera marina)*, associated epifauna, and zooplankton in the lower Chesapeake Bay. Prey preferences were examined through comparison of gut analysis and field abundances of prey species. These observed preferences are discussed with regard to the relative size of the prey species and its 'availability' in relation to other prey species. Prey 'availability' was found to be the dominant characteristic of a prey in determining its utilization by pipefish. Prey size was found to be relatively unimportant, except in determining mechanical restrictions, i.e., which prey were physically too large to be consumed.

84-002264 Savino, J. F and R. A. Stein. BEHAVIORAL INTERACTIONS AMONG FISH PREDATORS AND THEIR PREY: THE INFLUENCE OF HABITAT HETEROGENEITY AND PREY MORPHOLOGY. *Bull. Ecol. Soc. Am.* 63(2). June 1982. Abstract only. SFA 29(3)
[Ohio State Univ., Columbus] We compared the response of three prey fishes to a common predator in four pools, each with a different density of simulated vegetation. Bluegills *(Lepomis macrochirus)*, fathead minnows *(Pimephales promelas)*, and golden shiners *(Notemigonus crysoleucas)* were presented separately to largemouth bass *(Micropterus salmoides)*. The predator modified its behavior in response to prey availability, switching from actively searching to ambush tactics as plant density increased. Largemouth bass captured fathead minnows and golden shiners at all stem densities, but could not capture bluegills at medium and high stem densities. Shiners and minnows showed little response to the predator; they always schooled, except at high density when they scattered. In contrast, bluegills responded to the predator at all plant densities, changing the degree of schooling and moving to areas of greatest refuge. Predation success of largemouth bass appeared related to prey morphology, encountered rates with prey, and visual contact with prey.

84-002265 Seki, J.; H. Mayama and I. Shimizu. [FOOD AND FEEDING HABIT OF JUVENILE SALMON (GENUS *ONCORHYNCHUS*) IN COASTAL WATERS OF ISHIKARI BAY, HOKKAIDO-I-HORIZONTAL DISTRIBUTION OF FOOD ORGANISMS OF THE COASTAL WATERS IN SPRING, 1977-1981.] *Sci. Rep. Hokkaido Salmon Hatchery* No. 38. p. 1-24. Mar. 1984. In Japanese with English summ. SFA 29(3)
[Hokkaido Salmon Hatchery, Nakanoshima, Toyohiraku, Sapporo, Hokkaido, Japan]

84-002266 Shafland, P. L. and J. M. Pestrak. PREDATION ON BLUE TILAPIA BY LARGEMOUTH BASS, IN EXPERIMENTAL PONDS. *Proc. Annu. Conf. Southeast Assoc. Fish Wildl. Agencies* 35:443-448. 1981. SFA 29(3)

FOODS/FEEDING (CONTINUED)

84-002266 CONTINUED
[Non-Native Fish Res. Lab., Fla. Game Fresh Water Fish Comm., 801 N.W. 40th St., Boca Raton 33431]

84-002267 Siegel, D. M. ASPECT OF THE FEEDING ECOLOGY OF SNAPPER FISHES (LUTJANIDAE). M.S. thesis, Univ. West Fla. 1983. *From Masters Abstr.* 22(2):205. June 1984. SFA 29(3)

84-002268 Stein, R. A.; C. G. Goodman and E. A. Marschall. USING TIME AND ENERGETIC MEASURES OF COST IN ESTIMATING PREY VALUE FOR FISH PREDATORS. *Ecology* 65(3):702-715. June 1984. SFA 29(3)
[Dep. Zool., Ohio State Univ., Columbus 43210] In the predator-prey interaction between redear sunfish *(Lepomis microlophus)* and benthic, freshwater snails *(Physa, Helisoma,* and *Oxytrema),* we document selective predation among genera and sizes of prey and use optimal foraging theory in an attempt to explain diet selection. In experiments, sunfish strongly selected against *Osytrema* and weakly discriminated between *Physa* and *Helisoma,* with *Physa* most often chosen; size selection within any genus did not occur. Among genera, selection results were consistent with differences in shell strength and a time cost/benefit (C/B) construct operationally defined as handling time divided by prey dry mass. Within any genus, neither shell strength (smallest snails had weakest shells) nor time C/B (largest snails had minimal C/B) provided predictions consistent with results from selective-predation experiments. To explain this discrepancy, we measured metabolic costs of handling and energy content of prey. Dividing net energy of prey (E, generated by subtracting the energetic cost of handling from prey energy content) by handling time (T) yielded values of E/T that were similar for *Physa* and *Helisoma.* Within either genus, E/T was always highest for largest snails. Thus, this construct also provided predictions inconsistent with our experimental results. Only an energetic C/B ratio, in which the energetic costs of handling were divided by the energetic value of the prey, was consistent with selection of *Physa* over *Helisoma* and no size selectivity within either genus. Whether predators add prey to their diet based on this construct is unknown at present. The lack of concurrence between theoretical predictions of how prey should be ranked by predators (i.e. according to energy gained per unit time expended) and our experimental results suggests these constructs should be re-evaluated. Unless we know the discriminatory ability of our predators (in terms of how fine a difference in prey types they can assess) and the currency used in making decisions, C/B or E/T constructs provide little insight into diet selection by predators.

84-002269 Stiven, A. E. and R. T. Kneib. COMPLEX PREDATOR-PREY INTERACTIONS IN THE INTERTIDAL VEGETATED SOFT-SEDIMENT BENTHIC COMMUNITY. *Bull. Ecol. Soc. Am.* 62(2):151. June 1981. Abstract only. SFA 29(3)
[Univ. N.C., Chapel Hill]

84-002270 Stouder, D. J. EFFECTS OF A SEVERE WEATHER DISTURBANCE ON THE FORAGING PATTERNS BY A GUILD OF FIVE TEMPERATE REEF SURFPERCHES. *Bull. Ecol. Soc. Am.* 63(2):124-125. June 1982. Abstract only. SFA 29(3)
[Univ. Calif., Santa Barbara]

84-002271 Sutherland, W. C. GROWTH RATE OF AN ESTUARINE CLAM AS AFFECTED BY PREDATION ON ITS SIPHONS BY JUVENILE FISH. *Bull. Ecol. Soc. Am.* 62(2):151-152. June 1981. Abstract only. SFA 29(3)
[N.C. State Univ., Raleigh]

FOODS/FEEDING (CONTINUED)

84-002272 Takamura, K. INTERSPECIFIC RELATIONSHIPS OF AUFWUCHS-EATING FISHES IN LAKE TANGANYIKA. *Environ. Biol. Fishes* 10(4):225-241. 30 May 1984. SFA 29(3)
[Lab. Anim. Ecol., Dep. Zool., Fac. Sci., Kyoto Univ., Sakyo-ku, Kyoto 606, Japan]

84-002273 Timms, R. M. and B. Moss. PREVENTION OF GROWTH OF POTENTIALLY DENSE PHYTOPLANKTON POPULATIONS BY ZOOPLANKTON GRAZING, IN THE PRESENCE OF ZOOPLANKTIVOROUS FISH, IN A SHALLOW WETLAND ECOSYSTEM. *Limnol. Oceanogr.* 29(3):472-486. May 1984. SFA 29(3)
[Sch. Environ. Sci., Univ. East Anglia, Norwich NR4 7TJ, England]

84-002274 Tricas, T. C. and J. E. McCosker. PREDATORY BEHAVIOR OF THE WHITE SHARK *(CARCHARODON CARCHARIAS)*, WITH NOTES ON ITS BIOLOGY. *Proc. Calif. Acad. Sci.* 43(14):221-238. 12 July 1984. SFA 29(3)
[Dep. Zool., Univ. Hawaii at Monoa, Honolulu 96822] The feeding behavior of the white shark *(Carcharodon carcharias)* was studied at Dangerous Reef, South Australia. Cinematographic analyses of shark feeding patterns show that a single bite action is comprised of a uniform sequence of jaw and head movements. The components are: 1) snout lift, 2) lower-jaw depression, 3) palatoquadrate protrusion, 4) lower-jaw elevation, and 5) a bout-ending snout drop. Durations for a complete bite action ranged from 0.750 to 1.708 s (mean = 0.985 s) for a 3.5 m (TL) subject. Various approach behaviors to baits were also documented. The stomach contents of nine white sharks captured in northern and central California waters consisted entirely of fish prey associated with inshore and pelagic habitats. Records of the stomach contents of 24 additional sharks were combined and analyzed, and indicated fish to be the most frequent prey items, while marine mammals were also common. Analysis of prey type in relation to shark size shows small sharks (<3 m) feed primarily on fish prey, while larger sharks feed on marine mammals, especially pinnipeds. Cursory field experiments and observations indicate sharks detect and are attracted to electric fields. Telemetric studies of white shark thermal biology show that they are warm-bodied, approximately 4-5 C above ambient water temperature. Length-weight records for 127 sharks were analyzed and found to have the relationship: $W=3{\cdot}8 \times 10^{-6} L^{3.15}$, where W is weight in kg and L is length in cm. The largest reliable record for a white shark is that of a 6.4-m, 3324-kg specimen captured near Cojimar, Cuba, in 1945. A hypothesis is proposed to explain the "bite and spit" paradox related to attacks on pinnipeds and humans. Comments concerning the risk associated with contemporary surfboard design are included.

84-002275 Unger, P. A. THE FEEDING STRATEGY OF *XENOMELANIRIS VENEZUELAE* (ATHERINIDAE) IN LAKE VALENCIA, VENEZUELA AND ITS IMPACT ON THE ZOOPLANKTON. *Bull. Ecol. Soc. Am.* 62(2):92. June 1981. Abstract only. SFA 29(3)
[Univ. Colo., Boulder]

84-002276 Van Leeuwen, J. L. and M. Muller. THE RECORDING AND INTERPRETATION OF PRESSURES IN PREY-SUCKING FISH. *Neth. J. Zool.* 33(4):425-475. Dec. 1983. SFA 29(3)
[Dep. Exp. Anim. Morphol. Cell Biol., Agric. Univ., Marijkeweg 40, 6709 PG Wageningen, Netherlands]

FOODS/FEEDING (CONTINUED)

84-002277 Waiwood, K. and J. Majkowski. FOOD CONSUMPTION AND DIET COMPOSITION OF COD, *GADUS MORHUA*, INHABITING THE SOUTHWESTERN GULF OF ST. LAWRENCE. *Environ. Biol. Fishes* 11(1):63-78. 15 June 1984. SFA 29(3)
[Mar. Fish Div., Dep. Fish. Oceans, Biol. Stn., St. Andrews, NB EOG 2XO, Canada]

84-002278 Wallace, J. C. and D. Aasjord. THE INITIAL FEEDING OF ARCTIC CHARR (*SALVELINUS ALPINUS*) ALEVINS AT DIFFERENT TEMPERATURES AND UNDER DIFFERENT FEEDING REGIMES. *Aquaculture* 38(1):19-33. 15 Apr. 1984. SFA 29(3)
[Inst. Fish., Univ. Tromsø, P.O. Box 3083 Guleng, N-9001 Tromsø, Norway] Alevins of Arctic charr (*Salvelinus alpinus*) were raised at four temperatures (3°, 6°, 8°, and 12°C) and at each temperature food was presented at three different points in development, viz. early in the yolk-sack period, at two-thirds yolk utilization and at yolk exhaustion. Growth and survival were studied. Initial feeding occurred at or shortly after swim-up at all temperatures, and temperature did not affect the developmental stage at which feeding began. Alevins to which food had been presented earliest grew more rapidly after feeding commenced at all temperatures except 3°C. Exogenous feeding enhanced growth, the alevins receiving food at yolk exhaustion having the lowest growth rate up to that point. Mortality was very low except at 12°C, which was a supra-optimal temperature for the rearing of charr alevins from the point of view of both growth and survival.

84-002279 Webb, P. W. BODY AND FIN FORM AND STRIKE TACTICS OF FOUR TELEOST PREDATORS ATTACKING FATHEAD MINNOW (*PIMEPHALES PROMELAS*) PREY. *Can. J. Fish. Aquatic Sci.* 41(1):157-165. Jan. 1984. In English with French summ. SFA 29(3)
[Sch. Nat. Resour., Univ. Mich., Ann Arbor 48109]

84-002280 Wiley, M. J. OBSERVATIONS ON THE EFFECTS OF PREDATOR ACTIVITY ON DIEL FORAGING PATTERNS OF INSECT PREY IN HUNT CREEK. *Bull. Ecol. Soc. Am.* 62(2):151. June 1981. Abstract only. SFA 29(3)
[Ill. Nat. Hist. Surv., Champaign] Ingestion rates and diel feeding patterns of key stream predators were used to estimate the relative risk of predation involved in various foraging strategies of prey in a Michigan trout stream. Vertebrate predators, *Salvelinus fontinalis* and *Cottus bairdi*, and the plecopteran *Isogenoides frontalis* were primarily day-active. The dominant invertebrate predator, *Rhycophila acropedes*-grp., was primarily night-active. Although invertebrate predators daily removed more than twice as much prey biomass as did vertebrate-predators, total cropping rates during the day and during the night were approximately equal. Assuming that prey activity increases the likelihood of detection by both visual and tactile predators, analyses of diel cropping rates suggests the following optimal prey strategies: (1)species primarily susceptible to vertebrate predators should be most active at night, (2)species primarily susceptible to invertebrate predators should be most active during the day, and (3)species equally susceptible to invertebrate and vertebrate predation should show no diel periodicity in activity rates. Comparisons of the predicted activity with activity observed *in situ* using time-lapse cinematography are presented for selected species.

84-002281 Woodin, S. A. PREDATION/DISTURBANCE IMPORTANCE IN MARINE SEDIMENTARY HABITATS: RUMOR OR FACT? *Bull. Ecol. Soc. Am.* 62(2):123. June 1981. Abstract only. SFA 29(3)
[Univ. S.C., Columbia]

FOODS/FEEDING (CONTINUED)

84-002282 Worobec, M. N. FIELD ESTIMATIONS OF THE DAILY RATION OF WINTER FLOUNDER, *PSEUDOPLEURONECTES AMERICANUS* (WALBAUM), IN A SOUTHERN NEW ENGLAND SALT POND. *Comp. Biochem. Physiol. A Comp. Physiol.* 78(1):183-196. 1984. SFA 29(3)
[Grad. Sch. Oceanogr., Narragannett, RI 02882-1197]

AGE AND GROWTH

84-002283 Abd el Rahman, A. and A. I. el Moghraby. USE OF THE FRONTAL BONE IN AGE DETERMINATION OF *LABEO HORIE* (PISCES, CYPRINIDAE) IN JEBEL AULIA RESERVOIR, SUDAN. *Hydrobiologia* 110:281-286. 23 Mar. 1984. SFA 29(3)
[Hydrobiol. Res. Unit, Fac. Sci., Univ. Khartoum, Sudan]

84-002284 Barnes, M. A. and G. Power. A COMPARISON OF OTOLITH AND SCALE AGES FOR WESTERN LABRADOR LAKE WHITEFISH, *COREGONUS CLUPEAFORMIS*. *Environ. Biol. Fishes* 10(4):297-299. 30 May 1984. SFA 29(3)
[P.O. Box 4177, St. John's, NF AIC 5Z7, Canada] Scale ages underestimate otolith ages of western Labrador lake whitefish. Discrepancies occur from age 4 or 5 and can be considerable.

84-002285 Barwick, D. H. and W. E. Lorenzen. GROWTH RESPONSES OF FISH TO CHANGING ENVIRONMENTAL CONDITIONS IN A SOUTH CAROLINA COOLING RESERVOIR. *Environ. Biol. Fishes* 10(4):271-279. 30 May 1984. SFA 29(3)
[U.S. FWS, 206 Highway 123 By-Pass, Clemson, SC 29631] Significant changes in growth of bluegills, *Lepomis macrochirus*, largemouth bass, *Micropterus salmoides*, and black crappie, *Pomoxis nigromaculatus*, were observed in Keowee Reservoir, South Carolina, during the 10 years (1968-1977) following impoundment. During this period the reservoir filled, water temperatures were increased by heated effluent from a nuclear power plant, and threadfin shad, *Dorosoma petenense*, were stocked. Growth was apparently regulated by abundance and size of prey eaten by fish; elevated water temperatures had no measurable effect.

84-002286 Bivings, A. E. IV and R. L. Noble. VARIATION IN FIRST YEAR GROWTH OF LARGEMOUTH BASS IN A NORTH TEXAS FARM POND. *Annu. Proc. Tex. Chap. Am. Fish. Soc.* 3:83-91. 1981. SFA 29(3)
[Dep. Wildl. Fish. Sci., Tex. A&M Univ., College Station 77843]

84-002287 Chang, B. D. and W. Navas. SEASONAL VARIATIONS IN GROWTH, CONDITION AND GONADS OF *DORMITATOR LATIFRONS* (RICHARDSON) IN THE CHONE RIVER BASIN, ECUADOR. *J. Fish Biol.* 24(6):637-648. June 1984. SFA 29(3)
[Dep. Fish. Oceans, West Vancouver Lab., 4160 Marine Dr., West Vancouver, BC V7V 1N6, Canada] Growth in length, condition, and gonads of a food fish, *Dormitator latifrons*, were studied in the Chone River basin, Ecuador, in 1981. The river was bordered by floodplains in the upstream freshwater zone, and by mangrove swamps and shrimp farms in the downstream estuarine zone. The climate was marked by wet (January to April) and dry (May to December) seasons. During the dry season, an earth dam in the river prevented movement of water and fish between upstream and downstream zones. At the end of the dry season, most of the upstream floodplains were dry, and the main fish refuges were in downstream areas in deep pools in the river upstream. During the floods, fish migrated from downstream areas towards upstream floodplains. Growth rates and condition increased when water levels were high or salinity

AGE AND GROWTH (CONTINUED)

84-002287 CONTINUED was low and decreased when water levels were low or salinity was high. Seasonal changes in gonads and abundance of juveniles indicated that repro-duction occurred during the floods, but there was some reproduction in the dry season. Reproduction occurred in upstream and downstream zones and appeared to be stimulated by a complex of factors, including water levels, currents and salinity. The yield in flood plain sites was estimated as *c.* 115 kg ha^{-1} in 1981.

84-002288 Evans, G. T.; J. C. Rice and E. M. P. Chadwick. PATTERNS IN GROWTH AND SMOLTING OF ATLANTIC SALMON *(SALMO SALAR)* PARR. *Can. J. Fish. Aquatic Sci.* 41(5):783-797. May 1984. In English with French summ. SFA 29(3)
[Fish. Res. Br., Dep. Fish. Oceans, P.O. Box 5667, St. Johns, NF AIC 5X1, Canada]

84-002289 Gershanovich, A. D. FACTORS DETERMINING VARIATIONS IN GROWTH RATE AND SIZE DISTRIBUTION IN GROUPS OF YOUNG PADDLEFISH, *POLYODON SPATHULA* (POLYODONTIDAE). *J. Ichthyol. (Engl. Trans. Vopr. Ikhtiol.)* 23(4):56-61. 1983. SFA 29(3)
[VNIRO, Moscow, USSR] The variability in weight and size of young paddlefish *Polyodon spathula* during rearing was studied. At high stocking densities there are great differences in the sizes of young fish due to differential growth. With a reduction of numbers, growth variability decreases. At high stocking densities energy expenditure increases in the young; this occurs as a result of competition for space. The competitive interrelationships lead to the emergence of a hierarchic structure in groups of young. The position of specimens in the hierarchy is determined by their rate of growth. A dominant position in the hierarchy leads to an increase in rate of growth.

84-002290 Guma'a, S. A.; M. E. Hamza and E. M. Suliman. ON THE RELIABILITY OF THE GROWTH RINGS IN TWO SPECIES OF THE FAMILY CHARACIDAE IN THE SUDAN. *Hydrobiologia* 110:333-338. 23 Mar. 1984. SFA 29(3)
[Dep. Zool., Fac. Sci., Univ. Khartoum, Sudan] The scales, opercula and vertebrae from 69 *Hydrocyon forskali* and 63 *Alestes dentex* were investigated for their reliability as aging structures. In both species the scales were unreliable due to their regenerative property, in spite of the clarity of their growth rings. Back-calculated lengths from the first growth ring laid on opercula and vertebrae resulted in values that coincided with the annual growth of the two species. In *H. forskali*, the mean back-calculated length from the two bones were 16.2 ±5.9 and 16.8 ±4.4 respectively, and for *A. dentex*, 11.1 ±1.7 and 12.8 ±1.8, respectively. Predictive equations for bone radius from fish length were written for both species. In this study, reliability was maximal between the observed and back-calculated lengths for both species ($r>0.95$).

84-002291 Helfman, G. S.; E. L. Bozeman and E. B. Brothers. SIZE, AGE, AND SEX OF AMERICAN EELS IN A GEORGIA RIVER. *Trans. Am. Fish. Soc.* 113(2):132-141. Mar. 1984. SFA 29(3)
[Zool. Dep., Inst. Ecol., Univ. Ga., Athens 30602]

84-002292 Henderson, P. A.; J. W. Whitehouse and G. H. Cartwright. THE GROWTH AND MORTALITY OF LARVAL HERRING, *CLUPEA HARENGUS* L., IN THE RIVER BLACKWATER ESTUARY, 1978-1980. *J. Fish Biol.* 24(6):613-622. June 1984.

AGE AND GROWTH (CONTINUED)

84-002292 CONTINUED SFA 29(3)
[Cent. Elec. Res. Lab., Kelvin Ave., Leatherhead, Surrey KT22 7SE, England] Herring larvae were sampled in the Outer Thames Estuary and the River Blackwater Estuary in the springs of 1978, 1979 and 1980. Data were collected on larval stage, yolk sac and post yolk sac, larval length and total larval numbers. Newly hatched larvae were 6.8±0.5 mm long and the growth rate of yolk sac larvae was estimated at 0.18 mm d^{-1} ($L=6.8\pm0.186t$). The growth rate of post yolk sac larvae increased to 0.43 mm d^{-1} ($L=11.48 \pm 0.43t$). Mortality estimates, derived from total numbers in the summed estuary segments, varied between the years and the cohorts within the year. In 1979 the mortality rates were 0.061 d^{-1} and 0.074 d^{-1} for the two cohorts. The mean size of the larval population was estimated at 2.48 $x10^9$ ($1.63-3.77x10^9$) which agreed well with population size estimates from egg laying and from catch in numbers at age together with estimated fishing mortality rates.

84-002293 Hoyt, R. D. NOTES ON VARIOUS GROWTH FEATURES OF THE PADDLEFISH IN THE OHIO RIVER. *Trans. Ky. Acad. Sci.* 45(1-2):75-76. Mar. 1984. SFA 29(3)
[Dep. Biol., West. Ky. Univ., Bowling Green 42101]

84-002294 Hudson, W. F. and F. J. Bulow. RELATIONSHIPS BETWEEN SQUAMATION CHRONOLOGY OF THE BLUEGILL, *LEPOMIS MACROCHIRUS* RAFINESQUE, AND AGE-GROWTH METHODS. *J. Fish Biol.* 24(4):459-469. Apr. 1984. SFA 29(3)
[BLM, 333 South Fourth Street, Coos Bay, OR 97420]

84-002295 Kawamura, G. and N. Washiyama. AGE DETERMINATION OF WILD-CAPTURED MILKFISH LARVAE AS INDICATED BY DAILY GROWTH INCREMENTS OF OTOLITH. *Bull. Jpn. Soc. Sci. Fish.* 50(1):171. Jan. 1984. SFA 29(3)
[Fac. Fish., Kagoshima Univ., 4-50-20 Shimoarata, Kagoshima 890, Japan]

84-002296 Kennedy, J. L. SEASONAL GROWTH OF THE TUI CHUB, *GILA BICOLOR*, IN PYRAMID LAKE, NEVADA. *Great Basin Nat.* 43(4):713-716. 31 Oct. 1983. SFA 29(3)
[West. Mont. Coll., Dillon 59725] Tui chubs collected from November 1975 through November 1977 from Pyramid Lake, Nevada, were analyzed for seasonal growth patterns. Major growth in length occurred during the fall and early winter, and major reproductive development occurred during the late spring and early summer.

84-002297 Kitagawa, D. and K. Kyushin. AGE AND GROWTH OF SPOTTYBELLY GREENLING, *HEXAGRAMMOS AGRAMMUS* (TEMMINCK ET SCHLEGEL), IN THE SHORE REEF AT MOHEJI, SOUTHERN HOKKAIDO. *Bull. Fac. Fish. Hokkaido Univ.* 35(1):8-16. Mar. 1984. In Japanese with English summ. SFA 29(3)
[Iwate Pref. Fish. Exp. Stn., 1-4-21 Shinhama-cho, Kamaishi, Japan, 026]

84-002298 Lee, W. Y.; G. J. Holt and C. R. Arnold. GROWTH OF RED DRUM LARVAE IN THE LABORATORY. *Trans. Am. Fish. Soc.* 113(2):243-246. Mar. 1984. SFA 29(3)
[Univ. Tex. Mar. Sci. Inst., Port Aransas Mar. Lab., Port Aransas, TX 78373]

AGE AND GROWTH (CONTINUED)

84-002299 MacCrimmon, H. R.; T. A. Dickson and R. J. Gibson. IMPLICATIONS OF DIFFERENCES IN EMERGENT TIMES ON GROWTH AND BEHAVIOUR OF JUVENILE ATLANTIC SALMON (*SALMO SALAR*) AND BROOK CHARR (*SALVELINUS FONTINALIS*) IN SYMPATRIC STREAM POPULATIONS. *Nat. Can. (Que.)* 110(4):379-384. 1983. In English with French summ. SFA 29(3)

[Dep. Zool., Univ. Guelph, Guelph, ON N1G 2W1, Canada] In a cool second-order stream with a natural supply of food, growth rates of both wild and hatchery-reared Atlantic salmon juveniles were suppressed in sympatric popualtions with larger wild charr. However, in an experimental stream tank, where underyearlings were of the same average size and food was unlimited, neither species had an advantage. The extent and frequency of behavioural displays utilized by charr, wild and hatchery-reared salmon were the same for the two locations. Growth of both salmon and charr was less in the tributary stream than in the experimental stream tank. The ecological implications of differences in natural alevin emergent times of charr and salmon are discussed.

84-002300 Manooch, C. S. III and R. H. Matheson III. AGE, GROWTH AND MORTALITY OF GRAY SNAPPER COLLECTED FROM FLORIDA WATERS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 35:331-344. 1981. SFA 29(3)

[NMFS, Southeast Fish. Cent., Beaufort Lab., Beaufort, NC 28516] Otoliths and scales of gray snapper, *Lutjanus griseus*, sampled from the Florida headboat fishery were examined to see if they could be used to age the species. Scales were not useful, but sectioned otoliths proved to be excellent for determining age and growth. Rings could be identified and counted on 91% of all otoliths examined, and measurements could be made on 86%. The oldest fish encountered was 21 years; 775 mm TL. Back-calculated lengths at annulus formation ranged from 95 mm for age 1 to 772 mm for age 19. The von Bertalanffy equation describing theoretical growth is $l_t = 890\ (1-e^{-0.1005(t+0.3161)})$. Gray snapper were fully recruited to the hook and line fishery as 5 to 7 year olds depending on the area. Total instantaneous mortality estimates for fish landed in North Florida (Mayport and Daytona) and South Florida (Pompano, Boynton and Key West) were significantly different. A yield-per-recruit model is presented and should be useful in the future management of the species along the east coast of Florida. The length-weight relationship is $W = 2.4 \times 10^{-8} TL^{2.9122}$, where W = weight in kilograms. Length conversions are FL = 3.6476 + 0.9359TL, and SL = 2.7381 + 0.7781TL.

84-002301 Ohkuma, K. and H. Mayama. [ON THE STUDIES OF SCALE PATTERN AND GROWTH OF MASU SALMON (*ONCORHYNCHUS MASOU*) 1. AGE AND SCALE PATTERN IN FRESH WATER LIFE.] *Sci. Rep. Hokkaido Salmon Hatchery* No. 38. p. 25-32. Mar. 1984. In Japanese with English summ. SFA 29(3)

[Hokkaido Salmon Hatchery, Nakanoshima, Toyohiraku, Sapporo, Hokkaido, Japan] Masu salmon, *Oncorhynchus masou* (Brevoort), live mainly in the Japan Sea area and have a more characteristic life history than other species of Genus *Oncorhynchus*. Though they spend only one year at the sea their fresh water life is variable, and this fact makes it difficult to determine age from their scales. A consolidated effort was made to clarify and rectify these age determination difficulties in view of plans for masu salmon enhancement. We analyzed the scales of masu salmon parr, smolt and adults in Mena River, a branch of Shiribetsu River, Hokkaido. Number of circuli and scale radius (nucleus to the edge of 1st annulus) of 1^+ yr resident parr captured in July were 6 to 12 (mean 8.8) and 0.14 to 0.36 mm (mean 0.25 mm), respectively. Some of these 1^+ fish may migrate to sea in the following spring as 2^+ smolt based on our evaluation of their gonadal development. Age determination from 668 adult masu salmon which returned to Mena River in 1982 and 1983, revealed 4_3yr fish represented 6.7% (1982) and 9.4% (1983) of the fish while all others were 3_2yr fishes.

AGE AND GROWTH (CONTINUED)

84-002302 Pate, M. W. AGE AND GROWTH OF FLATHEAD CATFISH, *PYLODICTIS OLIVARIS*, IN THE RIO GRANDE RIVER, TEXAS. *Annu. Proc. Tex. Chap. Am. Fish. Soc.* 3:92-102. SFA 29(3)

84-002303 Pitre, R. L., and A. M. Landry, Jr. GONADAL DEVELOPMENT, GROWTH AND CONDITION OF SAND SEATROUT FROM LOUISIANA. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 35:647-653. 1981. SFA 29(3)
[Dep. Wildl. Fish. Sci., Tex. A&M Univ., College Station 77843]

84-002304 Quddus, M. M. A.; M. Shimizu and Y. Nose. COMPARISON OF AGE AND GROWTH OF TWO TYPES OF *HILSA ILISHA* IN BANGLADESH WATERS. *Bull. Jpn. Soc. Sci. Fish.* 50(1):51-57. Jan. 1984. SFA 29(3)
[Dep. Zool., Dhaka Univ., Dhaka, Bangladesh]

84-002305 Saeed, D. W. and J. Libosvarsky. SCALE GROWTH IN ROACH (*RUTILUS RUTILUS*) FROM THE MUSOV RESERVOIR, CZECHOSLOVAKIA. *Folia Zool.* 32(4):375-382. 1983. In English with Russian summ. SFA 29(3)
[Inst. Oceanogr. Fish., Egyptian Acad. Sci. Res. Technol., Alexandria, Egypt]

84-002306 Saul, B. M. and J. L. Wilson. FOOD HABITS AND GROWTH OF YOUNG-OF-YEAR WHITE BASS X STRIPED BASS HYBRIDS IN CHEROKEE RESERVOIR, TENNESSEE. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 35:311-316. 1981. SFA 29(3)
[TWRA Eagle Bend Fish Hatchery, Clinton, TN 37716]

84-002307 Sutter, F. C. and T. D. McIlwain. A PRELIMINARY INVESTIGATION OF AGE AND GROWTH OF SPOTTED SEATROUT COLLECTED IN COMMERCIAL FISH MARKETS. *J. Miss. Acad. Sci.* 28(Suppl.):84. 1983. Abstract only. SFA 29(3)
[Gulf Coast Res. Lab., Ocean Springs, MS 39564] Spotted seatrout, *Cynoscion nebulosus*, were obtained from commercial markets in the coastal counties of Mississippi as part of a study concerning the development of a data collection system to determine annual commercial harvest and value of each species of Mississippi marine finfish and shell fish. A critical part of this assessment in the understanding of the population biology of each species, which includes an accurate estimation of age and growth. The length-weight relationship for spotted seatrout collected from the commercial markets was: ln Weight (g) = -11.92 + 3.05, ln Total Length (mm), and condition factor (K) was equal to 0.905. Modal values of the length-frequency histogram coincided with mean length at age as determined from scale analysis (mean total lenght [mm] at age: II - 259.9, III - 299.8, IV - 339.13, V - 406.71, VI - 462,5, VII - 489.98, VIII - 526.5, X - 597.0). The lenght-frequency and lenght-weight relationships for market fish were compared with similar data for a gill netting program operating throughout Mississippi coastal waters during the same time frame, to determine whether both types of samples were being taken from the same portion of the spotted seatrout population. The preliminary results of the study give more validity for further analyses of market fish in terms of the population structure of spotted seatrout harvested commercially in Mississippi waters.

84-002308 Volk, E. C.; R. C. Wissmar; C. A. Simenstad and D. M. Eggers. RELATIONSHIP BETWEEN OTOLITH MICROSTRUCTURE AND THE GROWTH OF JUVENILE CHUM SALMON (*ONCORHYNCHUS KETA*) UNDER DIFFERENT PREY RATIONS. *Can. J. Fish.*

AGE AND GROWTH (CONTINUED)

84-002308 CONTINUED *Aquatic Sci.* 41(1):126-133. Jan. 1984. In English with French summ. SFA 29(3)
[Fish. Res. Inst., Univ. Wash., Seattle 98195]

84-002309 Wade, C. W. AGE AND GROWTH OF SPOTTED SEATROUT AND RED SNAPPER IN ALABAMA. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 35:345-354. 1981. SFA 29(3)
[Mar. Resour. Div., Ala. Dep. Conserv. Nat. Resour., Dauphin Island 36528]

84-002310 Wigtil, G. W. LACK OF CONSISTENCY OF AGE AND GROWTH ANALYSES IN OKLAHOMA. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 35:579-584. 1981. SFA 29(3)
[Okla. Dep. Wildl. Conserv., Norman 73069] Age and growth data pertaining to particular year-classes of largemouth bass (*Micropterus salmoides*), white crappie (*Pomoxis annularis*), bluegill sunfish (*Lepomis macrochirus*), white bass (*Morone chrysops*), gizzard shad (*Dorosoma cepedianum*), blue catfish (*Ictalurus furcatus*), and channel catfish (*I. punctatus*) from particular Oklahoma impoundments were tested for consistency of backcalculations at particular annulus formations among sampling years. A compilation of the results showed that there were significant differences (α=0.10), among what should have represented the same populations of scaly fish 69, 76, and 46% of the time for backcalculations at annulus I, annulus II, and annulus III, respectively. Significant differences among catfish data occurred 59 and 38% of the time at annulus I and annulus II, respectively.

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC.

84-002311 Acero P., A. and J. Garzón F. UNA REVISION DE LAS FICHAS DE IDENTIFICACION DE LA FAO PARA PECES MARINOS DEL ATLANTICO CENTRO -OCCIDENTAL, INCLUYENDO NUEVOS REGISTROS PARA EL CARIBE COLOMBIANO. [A REVISION OF THE IDENTIFICATION GUIDES OF THE FAO FOR MARINE FISH OF THE WESTERN CENTRAL ATLANTIC, INCLUDING NEW RECORDS FROM THE COLOMBIAN CARRIBEAN.] *An. Inst. Invest. Mar. Punta de Betin* 12:33-39. 1982. In Spanish with English summ. SFA 29(3)
[Invemar., Apt. Aéreo 1016, Santa Marta (Mag.), Columbia]

84-002312 Ali, M. T. FISHES AND FISHERIES OF LAKE NUBIA, SUDAN. *Hydrobiologia* 110:305-314. 23 Mar. 1984. SFA 29(3)
[Fish. Res. Cent., P.O. Box 1489, Khartoum, Sudan]

84-002313 Arthington, A. H.; R. J. McKay; D. J. Russell and D. A. Milton. OCCURRENCE OF THE INTRODUCED CICHLID *OREOCHROMIS MOSSAMBICUS* (PETERS) IN QUEENSLAND. *Aust. J. Mar. Freshwater Res.* 35(2):267-272. 1984. SFA 29(3)
[Sch. Aust. Environ. Stud., Griffith Univ., Nathan, Qld 4111, Australia]

84-002314 Baisden, V. W. JUVENILE PENAEID SHRIMP, BLUE CRAB AND FINFISH ASSESSMENT IN COASTAL GEORGIA. *Ga. J. Sci.* 42(1-2):11. Jan.-Apr. 1984. Abstract only. SFA 29(3)

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC. (CONTINUED)

84-002315 Bartels, C. E.; K. S. Price; M. L. Bussing and W. A. Bussing. ECOLOGICAL ASSESSMENT OF FINFISH AS INDICATORS OF HABITATS IN THE GULF OF NICOYA, COSTA RICA. *Hydrobiologia* 112(3):197-207. 30 May 1984. SFA 29(3)
[Univ. Del., Coll. Mar. Sci., Lewes 19958]

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[Hudsonia Ltd., Bard Coll., Annandale, NY 12504] The longitudinal distribution of fishes in the urbanized Bronx River does not follow the patterns seen in unimpacted streams. Downstream increase in species' numbers was paritally due to replacement, rather than entirely by addition. Comparison with the few other urban streams studied by others suggests the hypothesis that downstream replacement of species is typical of urban streams. In the Bronx River, untreated sewage and sand deposition were correlated with alterations in the species composition in the lower river. Sand substrates are too unstable to support the benthic communities necessary for subsistence of diverse fish communities. A high percentage of introduced and exotic fishes was also typical of the Bronx River fauna.

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84-002354 Anderson, C. S. INFLUENCE OF STREAM SIZE ON THE STRUCTURING OF SCULPIN POPULATIONS. *Bull. Ecol. Soc. Am.* 63(2):125. June 1982. Abstract only. SFA 29(3)
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[Coll. Environ. Sci. For., SUNY, Syracuse 13210] The deepwater sculpin (*Myoxocephalus thompsoni*) disappeared from Lake Ontario during the early 1950s after major predators had declined in abundance and in spite of the fact that the species was never commercially exploited. Evidence suggests that this local extinction may have been caused by the removal of a 'keystone' predator and the subsequent inability of the deepwater sculpin to survive increased competition with (or predation by) the native slimy sculpin (*Cottus cognatus*). The habitat and food requirements of slimy and deepwater sculpins overlap and both species are eaten extensively by the lake trout (*Salvelinus namaycush*). It is hypothesized that the lake trout may have prevented the slimy sculpin from monopolizing the benthic offshore regions of Lake Ontario but that once this predation was removed, the slimy sculpins became dominant in the lake at the expense of the deepwater sculpin.

84-002358 Edrington, C. J.; L. B. Starnes and P. A. Hackney. SUITABILITY OF CHEROKEE RESERVOIR AND THE UPPER HOLSTON RIVER FOR SAUGER AND WALLEYE. *Tenn. Valley Auth. (Norris)* NP-1903789. 29p. May 1979. From U.S. Gov.

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84-002358 CONTINUED Rep. 84(10):111. 11 May 1984. Available from NTIS as DE 81903789. Microfiche copies only. SFA 29(3)
This report synthesizes historic data for sauger and walleye in the Cherokee-Holston system and integrates them with recent studies in an effort to determine the factor(s) responsible for extirpation of these two species. The specific objective was to determine the effect, if any, that John Sevier Detention Dam and the associated steam-electric plant may have had on these two species. A description of this facility is given by TVA.

84-002359 Fortier, L. and W. C. Leggett. SMALL-SCALE COVARIABILITY IN THE ABUNDANCE OF FISH LARVAE AND THEIR PREY. *Can. J. Fish. Aquatic Sci.* 41(3):502-512. Mar. 1984. In English with French summ. SFA 29(3)
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84-002361 Guillory, V.; J. Geaghan and J. Roussel. INFLUENCE OF ENVIRONMENTAL FACTORS ON GULF MENHADEN RECRUITMENT. *La. Dep. Wildl. Fish. Tech. Bull.* No. 37. v + 32p. Sept. 1983. SFA 29(3)
[La. Dep. Wildl. Fish., New Orleans] The relationship between gulf menhaden (*Brevoortia patronus*) recruitment, as measured by catch-per-effort (CPE) of age-1 fish in the commercial fishery, and 11 different environmental factors were analyzed. Correlation coefficients were calculated between CPE and environmental conditions the preceeding year to identify crucial environmental factors and time periods. The critical time phase for recruitment was identified as December through March or the period of offshore spawning, larval drift, larval transformation, and early residency in the estuarine nursery grounds. The significant correlation coefficients between major environmental factors and CPE for the Louisiana gulf menhaden fishery were: -0.81 for January water temperature: -0.73 for incidence of January southeast wind; +0.68 for March salinity; -0.66 for January tide level; 0.62 for February Mississippi River discharge; and -0.54 for March wind speed. Regression equations using air or water temperature can be used to predict CPE of age-1 fish for various menhaden harvest regions along the Louisiana coast well in advance of the fishing season. The postulated mechanism behind the influence of examined environmental factors on gulf menhaden recruitment is the match/mismatch of larvae of food--that is, the better the larval and overall plankton production peaks are synchronized, the more successful is recruitment.

84-002362 Hartig, J. H. and D. J. Jude. OPPORTUNISTIC CYCLOPOID PREDATION ON FISH LARVAE. *Can. J. Fish. Aquatic Sci.* 41(3):526-532. Mar. 1984. In English with French summ. SFA 29(3)
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84-002363 Hubbs, C. and B. L. Jensen. EXTINCTION OF *GAMBUSIA AMISTADENSIS*, AN ENDANGERED FISH. *Copeia* 1984(2):529-530. 1 May 1984. SFA 29(3)
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84-002364 Karpenko, V. I. INFLUENCE OF ENVIRONMENTAL FACTORS ON QUALITATIVE PARAMETERS OF JUVENILE FAR-EASTERN SALMON OF THE GENUS *ONCORHYNCHUS* (SALMONIDAE) IN KAMCHATKAN WATERS OF THE BERING SEA. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 23(5):93-101. 1983. SFA 29(3)
[KoTINRO, Petropavlovsk-Kamchatskiy, USSR]

84-002365 Kashuba, S. A. and W. J. Matthews. PHYSICAL CONDITION OF LARVAL SHAD DURING SPRING-SUMMER IN A SOUTHWESTERN RESERVOIR. *Trans. Am. Fish. Soc.* 113(2):199-204. Mar. 1984. SFA 29(3)
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84-002366 Kayev, A. M. FACTORS INFLUENCING SURVIVAL OF CHUM SALMON, *ONCORHYNCHUS KETA* (SALMONIDAE), DURING THE EARLY MARINE PERIOD. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 23(5):7-17. 1983. SFA 29(3)
[SakhTINRO, South Sakhalinsk, USSR]

84-002367 Layher, W. G. HABITAT SUITABILITY FOR SELECTED ADULT FISHES IN PRAIRIE STREAMS. *Ph.D. dissertation, Okla. State Univ.* 354p. 1983. From Diss. Abstr. Int. B Sci. Eng. 44(10):2983. Apr. 1984. SFA 29(3)

A methodology was developed to identify factors limiting to fish populations in warmwater streams. Population estimates and physical and chemical variable measurements at 420 stream sites were obtained from the Kansas Fish and Game Commission. These data were used to develop suitability curves for physical and chemical variables for eight fish species: largemouth bass, *Micropterus salmoides*; spotted bass, *M. punctulatus*; green sunfish, *Lepomis cyanellus*; white crappie, *Pomoxis annularis*; channel catfish, *Ictalurus punctatus*; orangethroat darter, *Etheostoma spectabile*; slenderhead darter, *Percina phoxocephala*; and central stoneroller, *Campostoma anomalum*. Discriminant function analysis was used to develop a predictive model for occurrence of each species. Stepwise multiple regression was utilized to identify variables which explained the variation in standing crop for a designated species. Data collected from Oklahoma was used to test the applicability of models constructed from the Kansas data. Models developed from the Kansas data failed to predict, with reliability, presence or absence of species or standing crops. However, when suitability indices based on the curves developed from the Kansas data set were assigned to the observations collected in Oklahoma, significant r^2 values resulted upon multiple regression analysis, explaining much of the variation in standing crop. Similarly, discriminant function analysis separated presence and absence locations for individual species well when performed on the Oklahoma data set. Variables which are limiting to a fish population in one geographic area may not be the same variables limiting in another geographic area. Evidence that suitability curves have wide applicability was found. Utilization of these suitability curves can aid in identifying limiting factors to fish populations and development of predictive models to estimate fish population or occurrence in restricted geographical areas or stream segments.

84-002368 McMahon, T. E.; J. W. Terrell and P. C. Nelson. HABITAT SUITABILITY INFORMATION: WALLEYE. *U.S. Fish Wildl. Serv.* FWS/OBS-82/10.56. vii + 43p. Apr. 1984. SFA 29(3)
[WELUT, 2627 Redwing Rd., Fort Collins, CO 80526-2899]

84-002369 Meador, M. R.; A. G. Eversole and J. S. Bulak. UTILIZATION OF THE SANTEE RIVER SYSTEM BY SPAWNING BLUEBACK HERRING. *N. Am. J. Fish. Manage.* 4(2):155-163. 1984. SFA 29(3)

[Savannah River Ecol. Lab., Drawer E, Aiken, SC 29801] Densities of larval blueback herring (*Alosa aestivalis*) were determined in Wee Tee Lake, a backwater tributary of Santee River, South Carolina and at two adjacent main channel river sites during the 1981 and 1982 spawning seasons. Densitites of larval herring were significantly greater ($P<0.05$) during both spawning seasons in Wee Tee Lake than areas sampled in the Santee River, indicating the lake was extensively used for spawning. The numbers of larval herring also were significantly greater ($P<0.05$) in 1981 than in 1982. Lower numbers of larvae in 1982 appeared to be linked to high flows and low water temperatures associated with flood control discharges in the Santee River immediately prior to the 1982 spawning season.

84-002370 Nickelson, T. E. THE INFLUENCE OF OCEAN CONDITIONS ON ABUNDANCE OF COHO SALMON (*ONCORHYNCHUS KISUTCH*) IN THE OREGON PRODUCTION AREA. *Oreg. Dep. Fish Wildl. Fish Div. Inf. Rep.* 83-6. 23p. Dec. 1983. SFA 29(3)

[Res. Dev. Sect., Oreg. Dep. Fish Wildl., Corvallis] Upwelling explained 60% of the variation in landings of coho salmon, (an index of abundance), for the predominantly wild, 1944-56 broods, whereas streamflow during freshwater residence was not significantly correlated with landings. The influence of upwelling was similar for the hatchery enhanced, 1958-79 broods, but for any given level of upwelling, landings of hatchery enhanced population were about 2.3 times greater than those for the predominantly wild population. Marine survival models were developed for hatchery coho of the 1958-79 broods. These models suggest that upwelling, or factors associated with upwelling is the major factor influencing survival of Oregon hatchery coho and that smolt survival is independent of smolt numbers. A theoretical discussion of the control of coho salmon abundance in the Oregon Production Area is presented.

84-002371 Norcross, B. L. CLIMATE SCALE ENVIRONMENTAL FACTORS AFFECTING YEAR-CLASS FLUCTUATIONS OF ATLANTIC CROAKER (*MICROPOGONIAS UNDULATUS*) IN THE CHESAPEAKE BAY. *Ph. D. dissertation, Coll. William and Mary* 457p. 1983. From Diss. Abstr. Int. B Sci. Eng. 44(12):3608. June 1984. SFA 29(3) A conceptual life history of the Atlantic croaker (*Micropogonias undulatus*) identifies the effects of the environment on juvenile recruitment. In a multi-disciplinary approach to modeling, the major effects are investigated, quantified and presented in a flow chart. The model is divided into three sub models, each representing a major component which affects juvenile recruitment. North/south spawning location in the Mid-Atlantic Bight is affected by the bottom water temperature as influenced by the cessation of the summer winds in relation to timing of croaker migration. The pelagic phase is the most critical time in the life history of a larval croaker as they are subjected to wind-induced transport which may cause direct loss off the shelf and entrainment in the Gulf Stream, or indirect loss by prolonging time in transit to the nursery area. The magnitude of this wind-included effect is a function of the direction, strength, duration and time relative to spawning and is incorporated in an equation to predict year-class strength of croaker. The juvenile croaker overwinter in the Chesapeake Bay system. Winter temperature is shown to be the predominant variable affecting year-class survival to the following summer in very cold years. However, in very warm years, the predictive capabilities of the model are improved when a measure of fall recruitment, i.e. wind induced transport, is incorportated. Croaker is basically a density-independent stock as, juvenile recuitment is erratic and dependent upon these environmental parameters. The effect of spawning stock size is only apparent after accounting for density-independent effects, and

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84-002371 CONTINUED slightly improves the explained variance of the statistical relationship. Year-class strength and fishing pressure cause interannual variability in commercial catch. Overfishing a weak year class reduced spawning potential, and several poor year classes in a row magnify this. The model, tested for the 1982-83 data, predicts a strong year class.

84-002372 Quinlan, R. E. THE COLORADO RIVER CUTTHROAT TROUT (*SALMO CLARKI PLEURITICUS*); IMPACTS ASSOCIATED WITH INDUSTRIAL DEVELOPMENT WITHIN THE ROCKY MOUNTAIN REGION. *Proc. Annu. Conf. West. Assoc. Fish Wildl. Agencies* 62:548-554. 1982. SFA 29(3)

[Dames & Moore Environ. Consult., Denver, CO] Increasing development of water resources within the Rocky Mountain Region has generated concern over various fish species and their ability to recover from associated impacts. One such specie is the Colorado River Cutthroat Trout *(Salmo clarki pleuriticus)* inhabiting the North Fork of the Little Snake River in south-central Wyoming. The Colorado River Cutthroat has been classified as endangered in Utah, threatened in Colorado, and sensitive in Wyoming. The reproductive potential of this pure-strain population is apparently low, thereby, indicating the possible lack of ability to recover from the increased fishing pressure. A municipal water project has withdrawn water from this drainage for the past 19 years with additional withdrawals anticipated in the near future. If access is increased due to the con-struction and operation of additional diversion structures, a substantial increase in angling pressure can be expected. Future fish management programs implemented by the Regional Fishery Manager will need to consider the existing and projected harvest of the Colorado River Cutthroat within the North Fork of the Little Snake River drainage and the low reproduction potential of the species. Several options are available for the management and preservation of this unique fishery: (1) reduced creel limits, perhaps as low as two fish per day (2) catch and release regulations could be applied to the entire drainage, and (3) the drainage could be officially designated as a preserve for the Colorado River Cutthroat and closed to fishing.

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[Univ. Wis., Madison] Using data gathered by Birge, Juday, Hile et al. between 1928 and 1939 and our data from 1981, we compare cisco and zooplankton population levels across a 50-year period. Analyses are presented for three of the intensive study sites of the northern lakes LTER project. The abundance of cisco appears similar in two but has decreased in one lake from 1928-32 to 1981. The growth rates have increased in all three lakes. Historic zooplankton data span 9-11 years (1929-39, unpublished) and were collected at weekly or bi-weekly intervals during July and August. Preliminary analysis indicates that year-to-year trends in average zooplankton composition and abundance are similar in the three lakes. The abundances peaked in 1935 and 1936. Preliminary counts of 1981 data on composition and abundance are similar to those of 50 years ago. Some relationships between cisco and zooplankton abundance are indicated.

ABUNDANCE, FACTORS OF; SURVIVAL AND MORTALITY (CONTINUED)

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[Univ. Mass., Amherst]

84-002376 Veshchev, P. V. and A. S. Novikova. REPRODUCTION OF THE STELLATE STURGEON *ACIPENSER STELLATUS* (ACIPENSERIDAE), UNDER REGULATED FLOW CONDITIONS IN THE VOLGA RIVER. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 23(5):42-50. 1983. SFA 29(3)
[TsNIORKh, Astrakhan, USSR] The effectiveness of natural reproduction of the stellate sturgeon, *Acipenser stellatus*, was studied in the lower reaches of the Volga in years of differing flow and when a diversion dam was briefly in operation. Data are given on the downstream migration, age composition, and horizontal and vertical distribution of larvae in the river channel. The diversion dam influenced the dynamics of the sturgeon run, leading to a redistribution of spawning places. The reproductive efficiency of this species depends on a number of factors, but the flow volume during the summer low-water period is decisive.

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[Dep. Fish. Allied Aquacult., Ala. Agric. Exp. Stn., Auburn Univ., AL 36849] Channel catfish fingerlings were injected intraperitoneally with 2.0×10^4 viable *Edwardsiella ictaluri* cells. During the subsequent 4 days hematological and histopathological changes were determined, and bacterial counts were made in selected organs. There were significant reductions in erythrocytes and leucocytes. The mean corpuscular volume, and mean corpuscular hemoglobin concentration did not change significantly. Mean corpuscular hemoglobin changed significantly only at 72 hours. The hematocrit, hemoglobin, plasma glucose and plasma protein were reduced significantly. There were no significant changes in differential white blood cell counts. The liver was edematous and necrotic while the pancreatic tissue was necrotic. The spleen and trunk kidney appeared necrotic and an increase of lymphoid cells was also observed. Edema and cloudy swelling were observed in gill lamellae. Intestine and stomach were normal. Bacteria were abundant in spleen, trunk kidney and liver. Bacteria reached the maximum population at 96 hours post injection and declined at 6 days in all three organs.

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[U.S. FWS, Box 700, Kearneysville, WV 25430] An avirulent strain of *Aeromonas salmonicida* was shown to lack "A-layer" protein exterior to the outer cell membrane, but was still immunogenic in fish. After bacteria were inactivated with chloroform, whole cells, soluble antigen and combined whole cell plus soluble antigen vaccines were prepared. Those brook trout (*Salvelinus fontinalis*) that were vaccinated by a 60-second immersion in the combined whole cell plus soluble antigen vaccine were protected against experimental challenges. Further immersion vaccinations of Atlantic salmon (*Salmo salar*) in the combined vaccine indicated that protection conferred by immunization was highly significant, efficacious, and reproducible. In field situations, mortality in brown trout (*S. trutta*) immersion-vaccinated in this preparation was 2.1% whereas that in control fish was 28.9% after natural challenge.

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[U.S. FWS, Natl. Fish. Res. Lab., P.O. Box 818, La Crosse, WI 54601]

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[Dep. Med. Microbiol., Coll. Vet. Med., Univ Ga., Athens 30602] Channel catfish, *Ictalurus punctatus*, were immunized with cilia from three isolates of *Tetrahymena pyriformis* and challenged with *Ichthyophthirius multifiliis* using a reproducibile quantitative procedure. Two different methods of deciliation were used in antigen preparation. Results indicate that *T. pyriformis* cilia elicit an immune response in channel catfish against *I. multifiliis*, and that the protective ability of the cilia varies between *T. pyriformis* strains.

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[Great Lakes Res. Div., Univ. Mich., Ann Arbor 48109] Successful development of a commercial, small-mesh trap net fishery for round whitefish (*Prosopium cylindraceum*) in Saginaw Bay, Lake Huron, prompted analysis of round whitefish fillets for selected contaminants [dieldrin, dichlorodiphenyl trichloroethane and metabolites (DDT)], polychlorinated biphenyls (PCB'S), polybrominated biphenyls (PBB'S), chlordane, methyl mercury, and total mercury] to determine the fish's suitability for human consumption. Concentrations of all contaminants measured in 1977-1978 were below U.S. Food and Drug Administration action guidelines for fish; PBBs were below detection limits (0.001 mg/kg) for all fillets analyzed. Only PCBs and total DDT residues displayed a strong direct relationship with fish length. Fillets from males consistently exhibited higher mean concentrations of contaminants than did females. No changes in contaminant levels with season were observed.

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84-002510 CONTINUED Dorset DT4 8UB, England] Investigations made into the toxic effects of iodophor treatment of salmonid eggs confirm that presently recommended iodophor treatments are well within safety limits. The toxicity levels of one iodophor were established for eyed eggs over a wide range of concentrations and pH. With newly fertilized eggs it was shown that, provided the manufacturer's recommended methods are followed, no significant losses are to be expected. However, with higher concentrations of iodophor, a differential toxicity occured that depended on the hen fish used. The cause of the differential toxicity may be related to the 'age' of the egg within the hen.

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[Dep. Biol. Sci., Simon Fraser Univ., Burnaby, BC, Canada] The 96-h LC_{50} of acephate, a water-soluble organophosphorus insecticide, averaged 2,740 ppm for rainbow trout. Such low acute toxicity is apparently unique among commercial insecticides. Uptake of acephate by trout from water was rapid and reached equilibrium concentrations (4 to 6% of ambient concentrations) in 5 to 8 days. Methamidophos, a metabolite of acephate, formed rapidly reaching approximately 25% of the acephate concentrations in the fish. Elimination of 50% of acephate and methamidophos from rainbow trout required 1.73 to 2.43 days. Neither acephate nor methamidophos were bioconcentrated in the trout (mean BCF=0.0533). Predictions of bioconcentration of acephate, based on its water solubility, its octanol/water partition coefficient, or based on relationships developed in other studies, did not, as a rule, agree with our experimental results.

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[Cornell Univ., Ithaca, NY] A series of experiments were conducted in May 1980 to determine the effect of short-term hydrogen ion and aluminum perturbations on the chemistry and biology of dilute mountain streams. Hydrochloric acid (HCl) and aluminum chloride ($AlCl_3$) were experimentally added separately to different stream orders in the Hubbard Brook Experimental Forest. The experiments were designed to simulate short-term snowmelt episodes during spring. Calcium, Mg and Al were mobilized in the stream water in the experimental sections of all three stream orders, while free fluoride decreased significantly in the same areas. Sodium, NO_3, NH_4, SO_4 and PO_4 were not changed above and below the HCl or $AlCl_3$ perturbations. Our experimental results show that at a pH range (5.25-5.5) that did not elicit a behavioral response of aquatic invertebrates with HCl addition, $AlCl_3$ addition did produce a behavioral response. Therefore, dynamic fluctuation of aluminum chemistry at a pH range (5.2-5.5) that can be tolerated by most aquatic biota may be a primary factor in the alteration of community structure, metabolism and biogeochemistry of poorly buffered aquatic ecosystems.

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[Can. Cent. Inland Waters, Burlington, ON L7R 4A6, Canada]

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84-002544 Pimprikar, G. D.; J. E. Fondren, Jr.; D. S. Greer and J. R. Heitz. EVALUATION OF THE EFFECTS OF VARIOUS XANTHENE DYES ON MOSQUITO LARVAE AND PREDATORY MOSQUITO FISH. *J. Miss. Acad. Sci.* 28(Suppl.):73. 1983. Abstract only. SFA 29(3)
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84-002546 Sakanari, J. A.; M. Moser; C. A. Reilly and T. P. Yoshino. EFFECTS OF SUBLETHAL CONCENTRATIONS OF ZINC AND BENZENE ON STRIPED BASS, *MORONE SAXATILIS* (WALBAUM) INFECTED WITH LARVAL *ANISAKIS* NEMATODES.

TOXICOLOGY; BIOASSAYS (CONTINUED)

84-002546 CONTINUED *J. Fish Biol.* 24(5):553-563. May 1984. SFA 29(3)
[Cent. Mar. Stud., Univ. Calif., Santa Cruz 95064] Young of the year striped bass, *Morone saxatilis*, were exposed to sublethal concentrations of zinc and benzene and infected with larval *Anisakis* nematodes to deterine the effects of these stressors on various physiological parameters. Results indicated that both pollutants and parasites significantly decreased haematocrit values. Parasites alone increased the liver somatic index, decreased haematocrits and, in the initial phase of the experiment, lowered antibody titre. Pollutants alone did not appear to significantly affect antibody titres, nor was there any difference in zinc and benzene uptake in the livers of infected and non-infected fish.

84-002547 Seim, W. K.; L. R. Curtis; S. W. Glenn and G. A. Chapman. GROWTH AND SURVIVAL OF DEVELOPING STEELHEAD TROUT (*SALMO GAIRDNERI*) CONTINUOUSLY OR INTERMITTENTLY EXPOSTED TO COPPER. *Can. J. Fish. Aquatic Sci.* 41(3):433-438. Mar. 1984. In English with French summ. SFA 29(3)
[Dep. Fish. Wildl., Oak Creek Lab. Biol., Oreg. State Univ., Corvallis 97331]

84-002548 Siwicki, A. NEW ANAESTHETIC FOR FISH. *Aquaculture* 38(2):171-176. 1 May 1984. SFA 29(3)
[Inland Fish. Inst., Zabieniec near Warsaw, 05-500 Piaseczno, Poland] Anaesthetics are needed when handling fish, especially during tagging. However, most anaesthetics applied at present have a strong toxic effect on fish. For this reason it is only permissible to keep fish anaesthetized for a short time. A new anaesthetic "Propanidid" has been successfully tested which allows fish to be anaesthetized for up to 1 h. It can be applied as an intraperitoneal injection and as a bath solution. The required disappearance of sense perception and motor reflexes in the fish can be obatined in 2-4 min. Low toxicity of the pharmacological preparation has been proved according to a full set of the clinical, toxicological, haematological and biochemical criteria. Clinical tests were carried out with salmonids mainly. The new compound belongs to a group of anaesthetics which are used in human medicine; thus, it is considered to be harmless for man as an operator and a consumer.

84-002549 Soderberg, R. W.; M. V. McGee and C. E. Boyd. HISTOLOGY OF CULTURED CHANNEL CATFISH, *ICTALURUS PUNCTATUS* (RAFINESQUE). *J. Fish Biol.* 24(6):683-690. June 1984. SFA 29(3)
[Fish Cult. Prog., Dep. Biol., Mansfield Univ. Pa., Mansfield 16933] Dissolved oxygen and un-ionized ammonia concentrations were monitored in 12 0.04 ha earthen ponds stocked with 10 000 channel catfish, *Ictalurus punctatus*,/ha. Gill, liver and trunk kidney tissue samples were removed periodically for histological examination. Total ammonia and dissolved oxygen levels were in the ranges reported for catfish culture at this level of intensity. Average un-ionized ammonia nitrogen concentrations ranged from 20 to 67 $\mu g\ l^{-1}$ and average daily maxima ranged from 63 to 183 $\mu g\ l^{-1}$. Gill lesions characteristic of un-ionized ammonia exposure were common in fish from all ponds.

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[Pestic. Res. Cent., Mich. State Univ., East Lansing 48824]

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[British Columbia Hydro, 555 W. Hastings St. EGH-5, Vancouver, BC V6B 4T6, Canada] The *in vitro* effects of acephate, a water-soluble organophosphorus insecticide, on acetylcholinesterase (AChE) activity in rainbow trout were investigated over a range of 1,000 mg/L (5.5 mM) to 25,000 mg/L (136 mM). *In vitro* concentrations required to produce 50% inhibition of AChE in the brain and gill were 12,600 mg/L and 14,100 mg/L respectively. Since such concentrations would not occur in natural waters following use of acephate to control terrestrial insects pest populations, fish mortalities would not be expected.

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[Inst. Ichtiol. A.R. Zaktad Fizjol. Ryb, Szczecin, K. Krolewicza 3, Poland] Rainbow trout were exposed to a model mixture of water-soluble aromatic hydrocarbons (AH) at concentrations of 0.3-15.2 ppm for periods of 1-72 h. None of the parameters monitored except RBC changed at 0.3 ppm AH, while all constituents, except blood glucose, changed at 7.2 ppm AH. At 15.2 ppm, all fish died within 1 h. Haematological changes included increased haematocrit, haemoglobin concentration, erythrocye counts, and blood clotting (prothrombin) times. Plasma Cl^- concentration decreased significantly. Changes resembled a stress response except for the increased clotting times, which typically decrease, and lack of increase in blood glucose.

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[Int. Joint Comm., 3990 East Brood St., Columbus, OH 43219] The effect of stream channelization on macroinvertebrates, fish, and the sport fishery was studied in the Olentangy River at Columbus, Ohio. Macroninvertebrate abundance, diversity indices, standing stock in the benthos, and drift were significantly lower in a channelized area than in either a natural area

HABITAT ALTERATIONS (CONTINUED)

84-002577 CONTINUED or a channelized area mitigated with artificial riffles and pools. Predominant macroinvertebrates were moving-water forms in the natural and mitigated areas, and burrowing forms in the channelized areas. Diversity indices and realtive abundance of game fish were significantly lower in the channelized area than in the natural and mitigated areas. However, some nongame species became relatively abundant in the mitigated area when compared to the natural area. Composition of the sport fishing catch and catch rates accurately reflected the predominant fish community in each area. The biota in the area mitigated with artificial riffles and pools was similar to the biota in the natural area.

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84-002586 CONTINUED
Comparative effects of sheep and cattle grazing were studied on Marsh Creek in the headwaters of the Middle Fork of the Salmon River. Habitat data were primarily related to stream bank conditions and characteristics. Stream bank conditions on areas grazed by sheep were considerably more stable and of higher quality than stream bank conditions in the cattle use area. Vegetative stream cover resulting from grasses and willows was also greater in the sheep-use area. Results of the study indicated that kind of livestock as well as management prescription can have a strong influence on the relative compatibility of grazing and aquatic resources.

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[U.S. For. Serv., For. Sci. Lab., Boise, ID] A previously grazed riparian-stream habitat improved in many environmental conditions when management was changed from continuous grazing to complete rest. The most dramatic improvements were observed in the water column, streambank, and riparian vegetation, with a trend detected toward improvement of the channel morphology. The historical continuous grazing season is considered detrimental to the riparian-stream habitat. The plan to evaluate a new grazing strategy (rest-rotation) on this same habitat is discussed.

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[Dep. Zool., Univ. Toronto, Toronto, ON M5S 1A1, Canada] A modified design of a windermere trap, suitable for the capture of small fish, is presented. In direct comparison with more conventional gear, the trap was equally efficient in 26 southern Ontario lakes for pumpkinseed (*Lepomis gibbosus*) and brown bullhead (*Ictalurus nebulosus*). Efficiency was slightly reduced for largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieui*), yellow perch (*Perca flavescens*), rock bass (*Amploplites rupestris*), and golden shiner (*Notemigonus crysoleucas*). Length selectivity bias was minimal. Unlike standard gears, the trap weighs 1.5 kg, is stackable, and can be manufactured for approximately $10 (Canadian) in materials cost (polyvinyl chloride tubing, fiberglass flyscreen, and bamboo stakes) plus 4 hours of labour. Minimal impact on populations is possible because fish are captured live. The economy of construction and ease of deployment due to the light weight, stackability, and absence of leads or tensioning lines make it attractive for the sampling of these and similar fish.

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84-002629 CONTINUED to sample several streams in Wyoming and Utah representing a range of water quality conditions: alkalinity 12 to 1,530 ppm; pH 7.3 to 8.4; water temperature 45 to 70°F, and flows 2 to 300 cfs. The material was used to collect fish (through anesthesia) for length-weight analysis, stock estimates, and to remove fish completely from study sections. Sodium cyanide was effective in sampling streams which had proven difficult to sample by more conventional electrofishing techniques. The material is easy and safe to use provided nominal precautions are taken. Sodium cyanide should always be stored in waterproof, tamperproof containers until ready for use. When handling the chemical always wear rubber gloves and avoid any contact with skin. The material should be used on windless, dry days and common sense is a paramount consideration in working with sodium cyanide. Laboratory tests using cutthroat trout (*Salmo clarki*) showed that all test fish recovered from exposure to 1 ppm HCN for 10, 14, and 20 minutes and during 6 months of observation continued to eat and gain weight as would be expected for unexposed fish of the same species and age.

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MATHEMATICS, STATISTICAL METHODS, AND MODELING (CONTINUED)

84-002652 CONTINUED evaluate the fit between predicted and observed growth. A lack-of-fit test detected no significant lack of fit between similated and observed body masses; partitioning mean squared error showed that 76% of the variance was due to random variation rather than to systematic errors, and a reliability index indicated agreement between predicted and observed masses within a factor of 1.12. Growth simulations were relatively robust with respect to simulated errors in the input variables temperature and swimming speed, but were sensitive to errors in initial body mass. The model used observed growth to predict cumulative food consumption over the sampling season; the prediction was within 8.5% of an extrapolation from field data. Estimation of consumption rate as a constant proportion of maximum ration for the whole season was shown to be inappropriate; however, three intervals that used different constant proportions of maximum ration fit the data and corresponded to observed changes in bass diet.

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LAKE MANAGEMENT AND RESEARCH (CONTINUED)

84-002665 CONTINUED increased, species intolerant of low pH or requiring firm spawning substrates, as well as zooplanktivorous and bottom-feeding species, were eliminated. Species persisting into the final stages of senescence were food and habitat generalists, tolerant of low pH and low oxygen concentrations.

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[U.S. For. Serv., For. Range Exp. Stn., Boise, ID] We have about as many stream habitat evaluation systems as we have fisheries biologists. This would not be bad except that there is currently no concentrated effort to bring the systems together, to standardize the way the variables are being measured, or to select the family of variables needed for complete evaluation. At this time it is impossible to construct one comprehensive system, but we are ready to build and standardize several specific evaluation systems that will accurately and fully evaluate specific parts of the environmental spectrum selected for analysis. A habitat evaluation procedure is proposed that has 10 different process steps beginning with the acquisition of the data base and ending with the interpretation and decision making stages. The number of evaluation systems needed to handle the complexity of fisheries habitats and widely varying information needs is discussed.

84-002681 Wingate, P. J.; R. J. Brown; J. H. Davies; J. H. Mickey; W. R. Bonner and H. M. Ratledge. EFFECTS OF FISHING REGULATION CHANGES ON LOTIC WILD TROUT POPULATIONS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 35:654-660. 1981. SFA 29(3)
[Minn. Dep. Nat. Resour., St. Paul 55155] Effects of liberalized season and the institution of a trophy trout water classification were evaluated

RIVER AND STREAM MANAGEMENT AND RESEARCH (CONTINUED)

84-002681 CONTINUED at 35 sample stations on 24 trout streams. Trout standing crop significantly increased (0.05 level) at 1 station and significantly decreased at 2 stations. Two stations showed significant increases and 2 stations showed significant decreases in trout abundance. Analyses of pooled data for all streams indicated no significant change. Following the implementation of the 11-month season, trout standing crop increased in 50% of the streams and 71% exhibited an increase in trout abundance. The longer fishing season apparently has had little effect on the lotic population of wild trout. All trophy trout waters showed increased standing crops and abundances with significant increases (0.05 level) in standing crops in 2 streams and a significant increase in abundance in 1 stream. The trophy trout regulation has served to increase the wild trout biomass and abundance.

FARM POND AND SMALL IMPOUNDMENT MANAGEMENT AND RESEARCH

84-002682 Cichra, C. E. and R. L. Noble. SUMMER DRAWDOWN AS A FISHERIES MANAGEMENT TOOL IN FLOODWATER RETARDING STRUCTURES. *Annu. Proc. Tex. Chap. Am. Fish. Soc.* 3:1-21. 1981. SFA 29(3)
[Dep. Wildl. Fish. Sci., Tex. A & M Univ., College Station] During summer, 1977, six flood prevention lakes in central Texas were drawn down for determination of effects on fish, waterfowl, and water quality. The lakes were drawn down to approximately 50 percent of normal surface area and studied over a 3-year period. In spite of drought conditions, planted and natural vegetation became established on the exposed lake bottoms. Following refilling, water clarity, akalinity, and hardness generally increased. The 1977 year class of most fish species was reduced, but year classes for the years following refilling were typically large and fish condition improved. By early- to mid-1979, most fish populations were similar in abundance and size composition to their pre-drawdown conditions. Summer drawdown appeared to be of less value for fisheries managers than has been reported for fall drawdown in larger reservoirs. The effects of summer drawdown on waterfowl utilization were not evaluated because drought conditions caused low water levels to persist through the time of waterfowl migrations.

84-002683 Cichra, C. E.; R. L. Noble and B. W. Farquhar. RELATIONSHIPS OF WHITE CRAPPIE POPULATIONS TO LARGEMOUTH BASS AND BLUEGILL. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 35:416-423. 1981. SFA 29(3)
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84-002684 Johnson, W. E.; D. A. Dobbins and D. E. Holcomb. DRAWDOWN RESPONSE OF A HYPEREUTROPHIC FLORIDA LAKE. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 35:394-407. 1981. SFA 29(3)
[Fla. Game Fresh Water Fish Comm., Eustis 32726]

84-002685 Lawson, C. S. FISH UTILIZATIN OF MIDWATER AND BOTTOM FISH ATTRACTORS IN A FERTILIZED COMMUNITY FISHING LAKE. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 35:372-375. 1981. SFA 29(3)
[Div. Game Fish, Ala. Dep. Conserv. Nat. Resour., P.O. Box 366, Decatur 35602]

84-002686 Layzer, J. B. and M. D. Clady. EVALUATION OF THE STRIPED BASS X WHITE BASS HYBRID FOR CONTROLLING STUNTED BLUEGILLS. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 35:297-310. 1981. SFA 29(3)
[Fed. Energy Regul. Comm., 308 RB, Washington, DC 20426]

FARM POND AND SMALL IMPOUNDMENT MANAGEMENT AND RESEARCH (CONTINUED)

84-002687 McHugh, J. J. RESULTS OF A PARTIAL RENOVATION OF A PUBLIC FISHING LAKE. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 35:376-382. 1981. SFA 29(3)
[Va. Comm. Game Inland Fish, Fredericksburg 22401]

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84-002688 Baughman, J. FISHERIES IN LARGE WYOMING IMPOUNDMENTS--BUILDING NEW COMMUNITIES TO MATCH NEW ENVIRONMENTS. *Proc. West. Assoc. Fish Wildl. Agencies* 63:250-258. 1983. SFA 29(3)

84-002689 Carline, R. F.; B. L. Johnson and T. J. Hall. ESTIMATION AND INTERPRETATION OF PROPORTIONAL STOCK DENSITY FOR FISH POPULATIONS IN OHIO IMPOUNDMENTS. *N. Am. J. Fish. Manage.* 4(2):139-154. 1984. SFA 29(3)
[Ohio Coop. Fish. Res. Unit, Ohio State Univ., Columbus 43210]

84-002690 Frietsche, R. A. THE WARMWATER FISH COMMUNITY OF A COOL TAILWATER IN ARKANSAS. *Proc. Ark. Acad. Sci.* 36:28-30. 1982. SFA 29(3)
[U.S. FWS, P.O. Box 705, Ouachita Baptist Univ., Arkadelphia, AR 71923] A diverse warmwater fish community has persisted in the Lake Greeson tailwater, despite hydropower releases of cold hypolimnetic water. Forty-eight species of fish were collected by electrofishing in the upper 16.1 km of the tailwater. Hydropower releases have reduced the abundance of some of the warmwater sport fish in the upper tailwater, and their populations are probably maintained in part by recruitment from downstream. Angling effort has been diverted from the warmwater sport fish populations to a put-and-take trout fishery.

84-002691 Hecky, R. E.; R. W. Newbury; R. A. Bodaly; K. Patalas and D. M. Rosenberg. ENVIRONMENTAL IMPACT PREDICTION AND ASSESSMENT: THE SOUTHERN INDIAN LAKE EXPERIENCE. *Can. J. Fish. Aquatic Sci.* 41(4):720-732. Apr. 1984. In English with French summ. SFA 29(3)
[Freshwater Inst., 501 University Crescent, Winnipeg, MB R3T 2N6, Canada]

84-002692 Liebelt, J. THE UPS AND DOWNS OF FORT PECK RESERVOIR. *Mont. Outdoors* 15(4):33-37. July-Aug. 1984. SFA 29(3)

84-002693 Lusk, S. THE EFFECT OF THE NOVÉ MLYNY RESERVOIRS ON THE RIVER DYJE ON FISH CATCHES. *Folia Zool.* 33(1):19-28. 1984. In English with Russian summ. SFA 29(3)
[Inst. Vert. Zool., Czech. Acad. Sci., Brno, Czechoslovakia] The end of the first stage of reservoir building at Nové Mlyny on the River Dyje in South Moravia has had a favourable effect of fishing in the aquatic biotope affected, in the area of the confluence of the Dyje, the Svratka and the Jihlava. As a result of the building of two new valley reservoirs at Muov and Vestonice the area of fish-producing water has considerably increased, from 352 ha to 1,778 ha, though the 1,000 ha of the Vestonice reservoir has yet to be exploited for fishing. Although fishing is only undertaken by anglers -rod and line - there has been a considerable increase in catches in the area since the reservoirs were built. In 1975 to 1979 the average catch in the area was 38.49 tonnes per annum, whereas in 1981 it had risen to 83.28 tonnes and in 1982 it reached 110.66 tonnes. A large proportion of the total catch

LARGE IMPOUNDMENT MANAGEMENT AND RESEARCH (CONTINUED)

84-002693 CONTINUED consisted of species important for food and fishing - the common carp (1981 -43.95% and 1982 - 52.50%) and the pike (1981 - 43.18% and 1982 - 28.75%). A precondition for a further increase in the exploitation of the capacity for fish production in the area is an increase in the intensity of fishing, both in the sphere of angling and, particularly, industrial forms of fishing.

84-002694 Newbury, R. W. and G. K. McCullough. SHORELINE EROSION AND RESTABILIZATION IN THE SOUTHERN INDIAN LAKE RESERVOIR. *Can. J. Fish. Aquatic Sci.* 41(4):558-565. Apr. 1984. In English with French summ. SFA 29(3)
[Freshwater Inst., 501 University Crescent, Winnipeg, MB R3T 2N6, Canada]

84-002695 Ott, R. A., Jr. and S. P. Malvestuto. THE STRIPED BASS X WHITE BASS HYBRID IN WEST POINT RESERVOIR. *Proc. Annu. Conf. Southeast. Assoc. Fish Wildl. Agencies* 35:641-646. 1981. SFA 29(3)
[Tex. Parks Wildl. Dep., Rt. 10, Box 1043, Tyler 75707] The striped bass (♀) white bass (♂) hybrid (*Morone saxatilis* X *chrysops*) was first stocked into West Point Reservoir in May of 1978. Fishermen interviews established that a fishery had developed as early as January of 1979. The hybrid bass were stocked at 2 rates over the period of study, 84 mixed fry and fingerlings per hectare in 1978 and 150 mixed fry and fingerlings per hectare in 1979. Fish in the 1979 year class had a mean length at annulus 1 which was 48 mm greater than those stocked in 1978; threadfin shad (*Dorosoma petenense*) made up most of the diet, and increased growth in 1979 was apparently due to an increased abundance of threadfin shad. Bluegills (*Lepomis macrochirus*), gizzard shad (*D. cepedianum*), and largemouth bass (*Micropterus salmoides*) were also found in the stomachs of hybrids that were longer than 100 mm. Hybrid bass that had not yet progressed to a piscivorous diet relied heavily on insect larvae of the family chironomidae. There was no significant realtionship between prey size and hybrid mouthpart size or between prey size and hybrid length.

84-002696 Quiros, R.; B. L. Prenski and C. Baigun. RELACIÓN ENTRE RESULTADOS DE ENSAYOS DE CAPTURA Y FACTORES AMBIENTALES EN EL EMBALSE DE SALTO GRANDE. [RELATION BETWEEN CATCH PER UNIT EFFORT AND ENVIRONMENTAL FACTORS IN THE SALTO GRANDE RESERVOIR.] *Inst. Nac. Invest. Desarr. Pesq. Contrib.* No. 425. 22p. Apr. 1984. In Spanish with English summ. SFA 29(3)
[Inst. Nac. Invest. Desarr. Pesq., Mar Del Plata, Cas. Correo 175, Argentina]

84-002697 Schmidt, B. R.; B. Bonebrake and E. Larson. RESPONSE OF FLAMING GORGE TAILWATER TO OPTIMAL SUMMER RESERVOIR RELEASE TEMPERATURES RESULTING FROM PENSTOCK INTAKE MODIFICATION. *Proc. Annu. Conf. West. Assoc. Fish Wildl. Agencies* 62:457-465. 1982. SFA 29(3)
[Utah Div. Wildl. Resour.; P.O. Box 158, Dutch John 84023] The construction of Flaming Gorge Dam in 1962 created an excellent trout fishery in the Green River from the dam to the Colorado border, a distance of 48 river kilometers. As the reservoir filled, however, water was released from increasingly deeper and colder strata. By the late 1960's, mean discharge temperatures peaked late in the growing season and seldom exceeded 9 C, resulting in poor growth and survival of stocked rainbow and cutthroat trout fingerlings and a decline in the tailwater fishery. In a cooperative effort by the Utah

LARGE IMPOUNDMENT MANAGEMENT AND RESEARCH (CONTINUED)

84-002697 CONTINUED Division of Wildlife Resources and the U.S. Bureau of Reclamation, the outlet works of Flaming Gorge Dam were modified to allow the selective release of epilimnetic waters to the tailwater during the summer growing season. Peak river temperature rose to 13.5 C and temperature exceeded 11.5 C from June to October. Monthly growth of trout fingerlings during their first summer in the river more than quadrupled, and annual growth more than doubled. Currently, trout fingerlings stocked in May or June enter the creel during their first summer in hte river, whereas, previous to penstock modification, two growing seasons were required to reach an acceptable size. As a result of warmer tailwater temperatures, the Green River fishery experienced record levels of angling pressure, total harvest and yield during the 1981 angling season. The tailwater fishery in the Green River below Flaming Gorge Dam has undergone dramatic changes as the result of altered temperatures caused by the dam. The problems encountered in that fishery, and the solution which resolved them, could provide a valuable lesson when construction of new dams is being considered.

84-002698 Wagner, M. W. POSTIMPOUNDMENT CHANGE IN FINANCIAL PERFORMANCE OF THE SOUTHERN INDIAN LAKE COMMERICAL FISHERY. *Can. J. Fish. Aquatic Sci.* 41(4):715-719. Apr. 1984. In English with French summ. SFA 29(3)
[Treaty and Aboriginal Rights Res. Cent. Manitoba, Inc., 503-177 Lombard Ave., Winnipeg, MB R3B OW5, Canada]

84-002699 Weithman, A. S. and M. A. Haas. EFFECTS OF DISSOLVED-OXYGEN DEPLETION ON THE RAINBOW TROUT FISHERY IN LAKE TANEYCOMO, MISSOURI. *Trans. Am. Fish. Soc.* 113(2):109-124. Mar. 1984. SFA 29(3)
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[Dep. Environ. Sci., Univ. Va., Charlottesville 22903]

84-002701 Simenstad, C. A. THE ECOLOGY OF ESTUARINE CHANNELS OF THE PACIFIC NORTHWEST COAST: A COMMUNITY PROFILE. *U.S. Fish Wildl. Serv.* FWS/OBS-83/05. xii + 181p. Dec. 1983. SFA 29(3)
[Fish. Res. Inst., Coll. Ocean Fish. Sci., Univ. Wash., Seattle 98195]

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[Fish. Div., Dep. Primary Indus., P.O. Box 417, Konedobu, Papua New Guinea]

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[Rome, Italy]

84-002705 International Council for the Exploration of the Sea. REPORTS OF THE ICES ADVISORY COMMITTEE ON FISHERY MANAGEMENT. *Int. Counc. Explor. Sea Coop. Res. Rep.* 128. iv + 294p. Mar. 1984. SFA 29(3)
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84-002706 Lehtonen, H. SCIENTIFIC BASIS FOR FISHERIES MANAGEMENT OF VENDACE, *COREGONUS ALBULA* (L.), IN THE BOTHNIAN BAY. *Aquilo* 22:77-82. 1983. SFA 29(3)
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84-002708 Pacific Marine Fisheries Commission. 36TH ANNUAL REPORT OF THE PACIFIC MARINE FISHERIES COMMISSION FOR THE YEAR 1983. Pac. Mar. Fish. Comm. Annu. Rep. 36:1-37. 1 May 1984. SFA 29(3)
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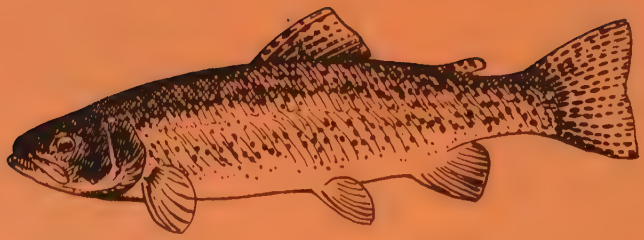

Africa
84-002345
Africa: Blue Nile
84-002108
Africa: Lake Kariba
84-002134
Africa: Lake Tanganyika
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Africa: Lake Victoria
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Alabama: West Point Reservoir
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Antarctic: Weddell Sea
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Arkansas: Lake Greeson
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Atlantic Ocean, South: Weddell Sea
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Canada: British Columbia: Georgia Strait
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Canada: Manitoba: Churchill River Diversion
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Canada: Manitoba: Cross Lake
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Canada: Newfoundland
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Canada: Nova Scotia
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Canada: Nova Scotia: Scotian Shelf
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Florida: Collier Cty.
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Idaho: Salmon River: Obsidian
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Japan: Otsuchi Bay
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Kentucky: Ohio River
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Michigan: Little Pigeon Creek
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Mississipi River
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Mississippi
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Mississippi River
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84-002482
Mississippi: Black Creek
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Mississippi: Hinds Cty.: Tallhalla Creek
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Mississippi: Tombigbee River
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Nevada: Ash Meadows
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Nevada: Devil's Hole
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Nevada: Pyramid Lake
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Nevada: Tabor Creek
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New Jersey: Lower Bay
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New York: Alleghany River
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New York: Allegheny River
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New York: Bronx River
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New York: Lower Bay
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New York: Seneca Lake
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Ohio River
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Ohio: Olentangy River
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Poteau River
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Oklahoma: McCurtain Cty.: Glover Ck.
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South Carolina: Keowee Reservoir
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South Carolina: Santee River
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South Dakota: James River
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Sudan
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Sudan: Blue Nile
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Sudan: Jebel Aulia Reservior
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Sudan: Jebel Aulia Reservoir
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Sudan: Lake Nubia
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Tennessee: Center Hill Reservoir
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Tennessee: Old Hickory Reservoir
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Tennessee: Watts Bar Reservoir
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Texas
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Texas: Bastrop Bayou
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Texas: Brazos River
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Texas: Lake Texoma
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USSR: White Sea
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